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An Enumeration of the Plants Collected by H. H. Rusby, in Bolivia, 1885–1886.—II.

By Elizabeth G. Britton.

MUSCI.

There has been a long delay in publishing this portion of the enumeration of Dr. Rusby's collection, because at the time that the first comparisons were made at Kew in the summer of 1888, I felt that further study, and, in many cases, better material would be necessary in order to accurately determine many of the species. Furthermore, all of Mandon's specimens, which were collected in the same localities which Dr. Rusby visited, such as La Paz and Sorata, were still lying in Schimper's herbarium undescribed and bearing only manuscript names.

In all instances when Dr. Rusby's specimens agreed with Mandon's the latter have been cited by number and locality, but as we did not possess at that time a set of Mandon's mosses, and my time at Kew was limited, it was impossible for me to write descriptions of all of the new species preserved in Schimper's herbarium collected by him. Hoping, however, that some one better fitted to do this than myself would have the opportunity of studying these Bolivian mosses, and also in recognition of the special privileges accorded to me at Kew while studying there, the first and most complete set of Dr. Rusby's duplicates was deposited there. The second set was sent, after having been carefully studied and named as far as possible by one unacquainted with

Tropical American genera, to Dr. Carl Müller, at Halle. He treated them in the same way that Schimper did Mandon's, giving most of them manuscript names, making few or no critical comparisons, and furnishing no descriptions. As far as we know, they are still lying in his herbarium unpublished.*

When we went to Europe, in 1891, I again took with me all the doubtful species and those supposed to be new, for the sake of making further comparisons at Kew with Schimper's specimens. In several cases, as shown in the text, I found that Dr. Müller was mistaken, and that my original determinations were correct; in several others I found manuscript names of Schimper's given to Mandon's specimens which had priority over those of Müller's given to Dr. Rusby's specimens. In several other cases the types were not at Kew, and the specimens had to be referred to William Mitten and Emile Bescherelle for further study. We visited Mr. Mitten and I showed him and gave him several species, the types of which were in his herbarium. He very kindly made the comparisons for me, and in several cases shared his specimens with me.

We also took a set of the duplicates for M. Bescherelle, and I spent a day with him at the Jardin des Plantes in Paris looking up some of Montagne's types. In a letter received from him at Kew he says:

"As for the mosses collected in Bolivia by Mandon, I think I remember that they were distributed by me in 1869, after the death of Mandon, which occurred on the 30th of December, 1866. Schimper named them, but did not describe or diagnose them. All of Mandon's mosses, Bolivian and Madeira, were sent to me by M. Cosson to be made up into sets, which were sold for the benefit of the widow. I kept one set and the residue, and proposed publishing at least the list of new species with the numbers and localities, in order to save Schimper's priority in the new discoveries. Unfortunately, other occupations have prevented my accomplishing this project. It will give me pleasure to share with you my duplicates."

We have to thank M. Bescherelle for a very good set of Mandon's mosses and we were also fortunate enough to secure Dr. Spruce's own private set of his Musci Amazonici et Andini, so

* Since this manuscript was sent to the printer we have learned that Dr. Müller is proposing to publish a Brylogia Boliviana in the Nuovo Giornale Botanico Italiano.

that we are now better able to study and compare Dr. Rusby's specimens.

In 1893 we received a much larger collection of mosses than Dr. Rusby's, made by Mr. Pierre Jay in northern Bolivia, also from the vicinity of La Paz and Sorata. I again wrote to M. Bescherelle, offering to send him a complete set if he would name them. He replied that he was so occupied with his studies of the mosses of Japan that he found it impossible to undertake it and that it was a thankless task acting as secretary for some one else. I might, perhaps, have been strongly tempted to take the same stand had there not been twelve pages skipped in the reprints of Dr. Rusby's enumeration and held in reserve for this list of mosses. Just as we are going to press I have received a postal card from M. Emile Levier, inquiring for the Bang collection of Bolivian mosses and telling me that Dr. Carl Müller is printing in Florence a *Bryologia Boliviana*. As my manuscript is completed and the priority of Schimper's names from Mandon's collections is maintained throughout, we think it best to publish our enumeration independently.

This summer I have also commenced wrapping and sorting Mr. Jay's collections and have found several of Dr. Rusby's new species in fruit, which had previously only been collected sterile, so that the work promises to be of great interest, but will take a good deal of time to accomplish with the limited collection at my disposal and the pressure of other duties. However, it seems best to publish the list of Dr. Rusby's collection as it stands, first with such determinations and descriptions as I now know to be correct, and to modify and amend this list subsequently as I find time to study and compare the fine collections made by Mr. Jay.

The sequence of genera followed is nearly that given by Mitten in his Musci Austro-Americani (Journ. Linn. Soc. 12: 12–25. 1869). Thirty-nine genera and ninety-six species are enumerated in this collection of which forty-two are new or previously undescribed. Six mosses, as many hepatics, four lichens and a few algae and fungi were also collected in Bolivia by A. M. Bang and enumerated by Dr. Rusby (Mem. Torr. Bot. Club, 4: 273). These were named by Mr. Wright at Kew, but the *Sphagnums* have since been examined and corrected by Dr. Warnstorf from specimens preserved in the Boissier Herbarium at Geneva.

Ceratodon Nova-Granatensis Hpe. Mapiri, 5000 ft. (3107)= Lindig, Nova Granada, Boq. Tequedamas, 1863.

Leptodontium gracilescens C. Müller. Yungas, 6000 ft. (3108); Sorata, 8000 ft. (3108a) *fide* C. Müller. E. Bescherelle says: "Affine *L. luteo* foliis tamen patulis haud appressis or minus longe cuspidatis differt."

At Kew in Herb. Hooker there are four specimens of Jameson's from the Andes of Quito, labelled *Didymodon luteum*, evidently the types of Hook. Lond. Journ. 5: 48. No. 174 is annotated by Wilson: "var. foliis magis recurvis patenti-recurvo serrulato." A part of 143 has the leaves much recurved as in 193b, both of which are sterile. On the same sheet is a specimen of G. Mandon's Plantae Andium Boliviensium Exsicc., no 1616, from vicinius Sorata labelled *Didymodon luteus* Taylor, which quite agrees with Rusby's specimens in its bright yellow recurved leaves, longer pedicels two or three in the same perichetium, and capsules twice longer than Jameson's specimen's.

LEPTODONTIUM GRACILE C. Müller, n. sp. Mapiri, 5000 ft (3111); Unduavi, 8000 ft. (3109).

Plants bright yellowish green, stems slender, leaves squarrose and curled when dry; cells densely papillose and obscure above, clearer and oblong below, margins entire and recurved to above the middle, sharply and doubly serrate above. Plants all sterile.

Allied to *Didymodon cirrifolius* Hpe. by its papillose leaves but with the aspect of *L. gracilescens* Müll. "Affine *L. luteo* foliis longioribus quam *L. gracilescenta* acutioribus margine non repetito denticulatis." E. Bescherelle, teste.

LEPTODONTIUM GRIMMIOIDES C. Müller, n. sp. Sorata, 13000 ft. (3192).

Plants dark and discolored below, tips of the branches bright yellowish green, stems 3–4 cm. long, leaves squarrose, spreading and curled when dry, remaining undulate when moist, margins entire and recurved below with a few protruding teeth above, vein generally excurrent into a cuspidate apex, cells clear but papillose at base, densely and finely papillose above. Plants sterile.

Leptodontium Mandoni Sch., *fide* C. Müller. Unduavi, 10000 ft. (3110). (Sterile.)

There is no specimen in Schimper's Herbarium at Kew bearng this name, so no comparison was possible. These specimens of Dr. Rusby's have the leaves strongly costate to the apex, the costa is papillose on the back, the margins are entire below, serrate and recurved above, papillose and undulate, the upper cells are small and round, but not opaque, the basal cells longer and brown.

HOLOMITRIUM BOLIVIANUM C. Müller, n. sp. Near Yungas, 4000 ft. (3190).

Plants in light yellowish tangled mats, mixed with hepatics; stems 3–4 cm. long, flexuous and matted, with light-colored tomentum; leaves 3–5 mm. long, linear lanceolate, twisted and curled when dry, costate to apex, serrate and papillose above as well as undulate, entire with revolute margins below; cells round and small, lower ones hyaline. Plants sterile.

This species was compared with *H. flexuosum* Mitt. at Kew, but it differs from No. 21 Spruce from Andes Quitenses in the leaves, nor does it agree with any other species from this region at Kew. It should be compared with *H. longifolium* Hpe.

Dicranella angustifolia Mitt. Near Yungas, 4000 ft. (3112).

DICRANELLA NANOCARPA C. Müller, n. sp. Near Yungas, 4000 ft. (3139 pp).

Stems 3–5 mm. high, simple or branching, leaves erect or slightly secund when dry, uppermost often 2 mm. long, linear-subulate, margin entire, vein excurrent with a few indistinct teeth at apex; perichetial leaves broader and clasping at base. Dioecious. Pedicels 5–8 mm. long, twisted above, bright orange; capsule erect, ovoid, less than .5 mm. long, with a longer straight beak on the lid than the theca, which becomes broad and hemispherical when empty; mouth with a dark border, peristome red, teeth fugacious; cells of the walls oblong or hexagonal in regular rows.

Only six plants found mixed with a specimen of *Philonotis*, No. 3139; the alliance was not determined.

DICRANUM SPECTABILE Sch. mss. Unduavi, 12000 ft. (3113.)

Plants stout and large, much discolored at base, glossy and yellow at the tips of the branches; stems 10–15 cm. long, decumbent, branching by short innovations, tomentose in the axils of the leaves, often slender and interruptedly foliate; leaves longest at the tips of the branches, often 15 mm. in length and 1 mm. broad at base, to a concave apex with involute margins, entire below, serrate, becoming spinose along the excurrent vein; basal

cells larger and brown, a few hyaline ones near the vein, others conspicuously porose, becoming long, spindle-shaped above and oblique along the margin. Monoecious antheridia in small buds on the tomentum in the axils of the leaves. Pedicels 15–20 mm. long, much twisted to the left; capsule 3–4 mm. long, erect, smooth, ovoid, largest at base, abruptly contracted or with a short neck; lid with a slender oblique beak 2 mm. long; mouth small, teeth short, slender and bifid.

Compared with and equal to Mandon Plantae Andium Boliviensium, No. 1609. Hab. vicinius Sorata, also Songo, 1857.

Nearest to *D. speciosum* Hk. & Wilson. Compared with No. 325 of W. Jameson's Pl. Aequatoriales from which it differs in its more slender habit, shorter leaves and pedicels half as long. Dr. C. Müller, also recognized this as a new species.

Dicranum species? Yungas, 6000 ft. (3115).

These specimens are sterile, and have baffled Dr. Müller, and Mr. Mitten as well. They have been compared with all the specimens at Kew likely to be the same. Mr. Mitten sent me a portion of his specimen of *Dicranum Mittenii* CM., but they do not agree. Dr. Müller named them *Campylopus concolor* Hook., but they were compared at Kew with specimens in Hooker's herbarium collected by Lindig in Bogota, and they differ in being much stouter plants of a glossy yellow color, with longer and broader leaves, which are serrate *only* at the apex and have a much broader blade.

Pilopogon gracilis Hook. Near Yungas, 6000 ft. (3159 in part).

Compared with Hooker's specimens at Kew collected by Weddell in the Province of Yungas, Bolivia, May, 1847, with which they agree in every way. The leaves are hyaline at the basal angles and these cells extend up along the margins; the short transverse walls of the cells are thickened; the vein is broad, the margins incurved, and there are a few teeth at the apex. The perichetial leaves end in a very long tip, often extending half the length of the pedicel.

Dr. Müller gave this a manuscript name under *Catagonio.*

CAMPYLOPUS TRIVIALIS C. M. n. sp. Mapiri, 2500 ft. (3196).

Plants loosely matted, dirty green; stems flexuous, not rigid, 3–5 cm. long, usually simple, occasionally with crowded branches

at the apex of the stems; stem leaves short, 3–5 mm. long, slightly falcate at the tips of the branches, tubular with incurved, entire margins; vein more than one-third of the width of the base of leaf excurrent with a few teeth at apex; basal cells thin, hyaline to the vein, not colored.

Plants sterile and much less rigid than is usual in this genus; their alliance was not indicated nor determined.

Campylopus sp. undetermined. Yungas, 6000 ft. (3116).

Plants fragmentary and broken. Stems 2–3 cm. high, proliferous with fasciculate branches at apex, branches often 15 mm. long with the leaves crowded at the summit; leaves curled and twisted when dry, 3–5 mm. long, blade narrow, forming a serrate border of one row of cells almost to the apex; vein papillose on the back; cells enlarged at base, brown at angles; leaves of the branches shorter, often entire, and radiculose at base, perichetial leaves very long pointed, costate, entire, or scarcely serrulate; cells much enlarged at base, brown, upper oblong; antheridia in heads matted with brown radicles; pedicels several in the same head, 8–10 mm. long, curved, becoming erect where dry; capsules 1.5 mm. long, ovoid, not ribbed when dry; peristome red, lid not seen.

These specimens are closely allied to *C. annotinus* Mitt., and *C. brachyphyllus* Mitt., and *C. multicapsularis* Sch., from all of which they differ in the leaves and the smooth walls of the capsules when dry.

GRIMMIA NANO-GLOBOSA C. M. n. sp. Mapiri, 5000 ft. (3195).

Plants pulvinate in gray cushions, stems 5–8 mm. high; leaves crowded with a long, rough, white hair-point, blade carinate, cells small, almost quadrate, sinuous, basal ones elongated. Dioecious(?). Perichetial leaves with a long sheathing base, the white tip reaching the lid of the capsule. Pedicel erect, straight, 3–4 mm. long; calyptra lobate-mitrate, capsules 1–1.5 mm. long, lid with a straight beak, .5 mm. long; annulus narrow, of several single rows of cells falling in fragments with the lid; peristome red; teeth short, papillose; spores smooth, .008–.010 mm.

A smaller species than either *G. ovata* Web. & M., or *G. longirostris* Hook.

Compared at Kew with Matthews' Peruvian specimens labelled *G. ovata* and illustrated by W. Wilson. The Bolivian specimens are smaller.

Grimmia (*Racomitrium*) *crispipila* (Taylor) Mitt. Sorata, 10000 ft. (3117).

Agrees with specimens at Kew collected by Pearce at Undu-

avi and Yungas, duplicates of which are in our collection, sent by Mr. C. H. Wright with the permission of the Director.

GRIMMIA (RACOMITRUM) DIMORPHUM C. Müller, n. sp. Unduavi, 10000 ft., Oct., 1885 (3118).

Plants in dark dirty mats, stems blackened beneath, decumbent, giving off lower branches 3–4 cm. long, branchlets short, fasciculate; leaves subsecund, incurved and twisted when dry, spreading when moist, carinate, plicate with one strongly involute margin, generally blunt apex, but occasionally with a white mucronate tip or the apical ones with white crisped tips, vein prominently keeled, ending below the blunt apex or continuous into the white prolongation; cells all uniformly sinuous, elongated with faint transverse walls; perichetium short, 3 mm. long, broadly convolute, sheathing; bracts broad, apex acute, cells scarcely sinuous. Pedicels short, less than 1 cm., long, arcuate, twisted; capsule erect, or bent, 3 mm. long, smooth except just below the small dark bordered mouth; lid 1 mm. long, conic beaked, teeth long, slender, papillose, yellow.

Compared with *R. crispipilum* Taylor in Herb. Hooker, nos. 135, *a*, *b*; Spruce Musci Am. et And.

Leaves less cirrous pointed than 135 *b*; stems shorter than 135; leaves exactly alike; capsules on shorter pedicels, less cylindric, shorter and broader, with a broader mouth. General aspect quite different.

Leucobryum longifolium Hpe. Mapiri, 2500 ft. May, 1886 (3119).

Sporophyte immature. Agrees with no. 71 c. of Spruce's Musci Amazon. et. And. and with no. 7169 of A. Glaziou from Rio Janeiro, both at Kew.

LEUCOBRYUM STRICTUM C. Müller, n. sp. Unduavi, 10000 ft., Oct., 1885 (3119a).

Plants short, loosely tufted, mats dull gray when dry, stems short, decumbent at base, less than 2 cm. high, brown when moist, with light tips; leaves erect and slightly spreading, iridescent when dry, about 1 cm. long by 2 mm. broad, concave from a broad white base, tubular and dark above the middle, margin narrowly hyaline, apex with a few brown cuspidate teeth.

Plants sterile, smaller and darker than *L. viridans* (Brid.). "Ab *L. longifolium* Hpe., cellulis chlorophyllis tantum latioribus differt." E. Bescherelle.

TORTULACEAE.

The treatment of this group by Mitten in his "Musci Austro-Americani" is far from satisfactory. It has seemed best, however, to follow him in this as in the other families. Duplicates of these were not sent to Dr. C. Müller, as they had not been carefully studied nor compared at that time. Later M. Bescherelle had a set of them, and made one or two comparisons for me with Montagne's types at the Jardin des Plantes. It will require more study and comparison with a more modern treatment of the family, before the specimens listed can be thoroughly understood.

Tortula (*Trichostomum*) *contortifolium* Mitt.? Unduavi, 8,000 ft. October, 1885 (3126).

There were no specimens of this species at Kew; hence these specimens were named only from the description on page 147 of Mitten's Musci Austro-Americani. They were shown to Mitten and sent to M. Bescherelle, but should be compared with Spruce, "No. 213, Andes Quitenses, Chimborazo (10000 ped.)"

TORTULA (*Trichostomum*) SEMIVAGINATUM Sch. mss. in Herb., no. 1618. Mandon, Plantae Andium Boliviensium. De Capanuta a Songo, 18 Obr., 1857, in Herb. Schimper. Vicinius Sorata, April, 1858, in Herb. Hooker. Near Yungas, 4000 ft., 1885, in Herb. Rusby, no. 3128.

Plants 2–3 cm. high, dark below, red-brown above; stems simple or branching by subapical innovations 1–2 cm. high; leaves curled and twisted when dry, spreading when moist from an erect, glossy clasping base, the lanceolate blade 2 mm. long, suddenly bent and contracted from the hyaline base, 1 mm. long, upper cells small, dense and with thickened irregular walls and small, blunt papillae, decurrent at the margins a short distance on each side of the clasping base, vein large, yellow, ending in the acute apex. Dioecious? Perichetial leaves smaller, with a longer, more sheathing base. Pedicels 5–15 mm. long, twisted in two directions; capsules 2–3 mm. long, straight, cylindric, smaller at the mouth; lid with a long curved beak, annulus large, falling with the lid; peristome fragile, pale, papillose, teeth long and slender, thickened and united at the basal joints, not twisted.

Closely related to *T. decolorans* Hpe., from which it differs in its larger size, longer, more spreading and clasping leaves and paler not twisted peristome.

Tortula (*Barbula*) *campylocarpa* Taylor. Unduavi, 8000 ft. October, 1885 (3127).

Compared with Spruce Musci Am. et And. nos. 185 and 201, agrees with specimens at Kew and has been verified by Bescherelle. Also compared with *T. rectifolia* Taylor, nos. 193–196, Spruce, from which it differs in its larger size and longer, more acuminate leaves.

BARBULA AUSTRO-REVOLUTA Besch. mss. Near La Paz, 10000 ft. April, 1885 (3129).

Plants in dense light yellowish-green or slightly glaucous, and dirty tufts; stems 1–2 cm. high with numerous, slender, subapical branches; leaves erect-spreading when moist, spirally twisted around the stem when dry, small, 1 mm. or less long, with strongly revolute margins and a broad, thick, yellow vein, ending in and forming the blunt apex; lower cells oblong, clear; upper smaller, denser and papillose; dioecious (?), perichetial leaves with a longer, more hyaline, clasping base. Pedicels light yellow, 5–7 mm. long; capsule 2 mm.; lid conic-beaked,cells spirally formed; peristome immature.

Closely related to no. 1622 of Mandon's Bolivian Mosses, collected in April, 1856, near Sorata, and labelled *B. glaucescens* in Herb. Schimper, but differing in the shorter, more blunt leaves, the more revolute margins, and in the yellow pedicel. Bescherelle says of it, "*B. revoluta* affinis sed foliis magis obtusa acuminatis glaucescentibus cucullatis; pedicello flavo, peristomio longe distat."

TORTULA (*Syntrichia*) sp.? Near Yungas, 4000 ft., 1885 (3124). Unduavi, 8000 feet. October, 1885 (3125 and 3127 pp).

Plants in dirty, yellowish-brown tuffs; stems 1–1.5 cm. high, branching; much abraded and discolored below; leaves erect-appressed when dry, tufted on the stems, upper, green with white hair-points, the vein papillose on back, and excurrent into a rough awn, apex rounded, margins involute; upper cells densely papillose, lower, clear and hyaline. Dioecious? Seta 10–12 mm. long, red below, twisted; capsule narrowly cylindric, 1 mm. long, straight or slightly arcuate when old, with a long-exserted columella; mouth small, annulus narrow, falling in fragments when old; peristome short or broken, twisted from a short basal membrane; teeth pale, papillose.

These plants were compared with several of Mandon's Plantae Andes Boliviensium, but their alliance was not determined by me while at Kew, nor by M. Bescherelle, to whom they were subsequently submitted.

Tortula (*Syntrichia*) *Andicola* Mont. Unduavi, 8000 ft. October, 1885 (3120). Sterile plants only collected.

Large sterile specimens answering the description given in the Ann. Sci. Nat. (Series 2, 953) and compared at the Jardin des Plantes with the type collected by D'Orbigny near La Paz, in the Bolivian Andes.

Tortula (*Syntrichia*) *aculeata* Wils.? Mapiri, 5000 ft. April, 1886 (3123); Sorata, 10000 ft.

Compared at Kew with Spruce, no. 144 and Jameson's specimens from Pichincha, both cited by Mitten under the description of this species. Ours agree with Jameson's better than Spruce's no. 144, and it would seem as if the two were distinct or the species very variable. Bescherelle also seems to think there is room for separation here, as he says: "*T. aculeata* Wils. affinior sed primo viso differt. Foliis integerrimis, magis papillosis, duplo longioribus, pilo valde longiore diversa, ut videtur—forsan species nova?

TORTULA (SYNTRICHIA) BIPEDICELLATA n. sp. Bescherelle, M. S. Mapiri, 5000 ft. May, 1886 (3123a).

Plants in small yellowish-brown tufts; stems 1–2 cm. high; leaves not crowded, curled and twisted when dry, 3–4 mm. long, without a hyaline point, the vein stout and brown, but ending in a short mucronate point at the apex of the leaves; margins plane or rarely slightly revolute below; upper cells densely papillose, lower large, clear and oblong. Dioecious perichetial leaves not differentiated. Pedicels mostly two together, about 1 cm. long, straw-colored; capsules 3–5 mm. with a long beaked lid, straight or slightly curved; mouth small, red; peristome not developed.

Closely related to *T. glacialis* Kze. Compared at Kew with Weddell's no. 20, collected in Bolivia, province of Larecaja, June, 1847, with which it agrees in the leaf characters but differs in having the pedicels more uniformly in pairs. There is a mixture also in this species at Kew, for the specimens collected by Liebmann on Mt. Orizaba and Poeppig in Chili are very different in aspect. Brescherelle says of them: "Affinis *T. glacialis* Kze., foliis tamen duplo-longioribus, ad summum planis haud undulatis; capsula geminore, peristomio non afformato."

Tortula fragilis Taylor? Sorata, 10000 ft. (3121).

Compared with specimens at Kew collected by Lindig, New

Granada, 2075, and Jameson's, from the Andes of Quito, 1847. Our plants are larger than Lindig's, the capsules longer and the pedicels single. The leaf is broadly undulate, ending in a short cusp, the marginal cells short, quadrate and papillose, the basal cells oblong and hyaline. The basal membrane of the peristome is very short, the teeth twisted once, white and granulose. Bescherelle says of this: "Folia ad basin margine recurvis, cellulis inferioribus similibus differe mihi videtur. *T. fragilis* (N. Grenada, Lindig, 2075) folia basi plana, ab cellulis marginales inferiore minores ut marginata habet: an *T. fragilis* forma peculiaris?"

Tortula Pichinchensis Taylor (*Barbula affinis* Hpe.). Ingenio del Oro, 10000 ft. (3122).

Compared at Kew with Spruce's nos. 185, 194, 197, 200–202 Andium Quitensium. Also verified by M. Bescherelle.

Orthotrichum pariatum Mitt. Sorata, 10000 ft., Feb., 1886 (3130).

Compared with no. 130 Spruce, And. Quit., with which it agrees.

Macromitrium Rusbyanum E. G. Britton, n. sp. Unduavi 12000 ft. October, 1885 (3188).

Plants large and showy in yellowish-brown tufts; stems 9–10 cm. long, repeatedly branching; leaves brown, broken and abraded on the lower parts of the stems, light yellow, longer and spirally twisted at the tips of the branches, 5–9 mm. long, lanceolate-linear, from a broader yellow or brown base, margins finely serrate above, vein ending in the channelled apex; lower cells elongated, porose; upper, shorter with thick protruding walls. Dioecious? Seta twisted or arcuate, 5 mm. long, stout; capsule almost globose, 2 mm. long, walls smooth and thick, brown and shining; lid conic-beaked; peristome double, outer, a thick fleshy membrane; inner, short, fragile, with bright yellow smooth teeth; calyptra, not seen; spores large, .0810–.0864 mm.

This is one of the handsomest species collected by Dr. Rusby and was dedicated to him by Dr. Müller, but referred to a new genus allied to *Leptodontium;* but after careful comparison at Kew with specimens of *Macromitrium trichophyllum* Mitt., and *M. scoparium* Mitt., I have concluded that its alliance is with these species. The absence of the calyptra is unfortunate, but in all other respects the likeness is very close, and the alliance is concurred in by William Mitten, to whom specimens were sent.

SCHLOTTHEIMIA RUSBYANA C. Müller, n. sp. Near Yungas, 4600 ft. 1883 (3191).

Plants densely matted together in dark red-brown cushions among the roots of orchids. Stems trailing, branches erect, about 1 cm. long; leaves densely crowded at the apex of the branches, erect-appressed and plicate when dry, 1–1.5 mm. long, oblong, obtuse, the vein ending in a short cuspidate apex; upper cells in regular transverse rows, the blade slightly undulate; lower elongated with thickened papillose ends. Plants sterile; alliance not determined.

Zygodon recurvifolius Sch. Sorata, Bolivia, 8000 ft. Feb., 1886 (3194.)

Compared with type in Herb. Schimper at Kew, no. 1629, G. Mandon Plantae Andium Boliviensium Exsicc. from Vicinius Sorata; also compared with no. 1627 *Z. ferrugineus* Sch., of the same Exsiccatae, Dr. Müller having determined Dr. Rusby's specimen as the last named species. It is unmistakably the former having much larger leaves which quickly become recurved when moistened. The plants also are not at all rusty. M. Bescherelle has subsequently supplied me with duplicates of Mandon's nos. 1629 and 2627 and I have recently been able to verify my previous determination.

ENTOSTHODON PAPILLOSUM E. G. Britton, n. sp. Sorata 10000 ft. Feb. 1886 (3131).

Plants scattered on hard, bare patches of earth; plants including the sporophyte 5–8 mm. high; leaves few, rosulate, long subulate, acuminate, the vein excurrent into or ending below the long slender tip, margins entire; cells very lax. Dioecious. Seta 5–8 mm. long, stout, densely papillose, erect or slightly arcuate when dry, sinuous when moist; capsule globose-pyriform, about 2 mm. long, including the stomatose neck; lid flat; peristome none; calyptra not lobed at base.

Allied to *E. Lindigii* Hpe. according to the description and key given by Mitten (Musci, Austro-Americani, p. 243), but differing in the densely papillose pedicel. This and the following species were found growing together in the same patches.

Entosthodon Lindigii Hpe.? (ex. descriptio.) Sorata 10000 ft. Feb. 1886 (3131).

Compared with specimens of *E. Mandoni* Sch. mss., no. 1645, Mandon, Bolivia, the leaves of which are less acuminate and have not a subulate tip; in both, the leaves are not bordered and

the mouth is small and surrounded by 3–4 rows of darker, denser cells. In *E. apiculatus* Sch., no. 1646 of Mandon, the lid of the capsule is beaked, not flattened as in our specimens, and the leaves are not subulate pointed.

Funaria hygrometrica (L.) Sibth. Near Yungas, 4000 ft., 1885 (3132a).

Growing mixed with *Bryum argenteum* var. *lanatum*.

Funaria calvescens Schwaegr. Near Yungas, 4000–6000 ft., 1885 (3133a); Unduavi, 8000 ft., Oct., 1885 (3133b).

FUNARIA INCURVIFOLIA C. Müller, n. sp. Near La Paz, 10000 ft., Oct., 1885 (3132).

Plants 1–2 cm., pale straw-yellow; stems often several together, 2–5 mm. high; leaves rosulate, 2–2.5 mm. long, incurved, carinate-cucullate; vein yellow, ending in the acuminate, incurved apex; margins with a narrow border of 1 row of elongated cells, entire or faintly subserrulate; cells of the basal angles large, swollen. Dioecious; seta 5–10 mm. long, pale yellow and twisted; capsule small, 1.5–2 mm., oblique-pyriform; annulus large, compound, falling with the blunt lid; teeth with projecting cross-bars; inner peristome present, of short slender segments.

Belonging to the section of *F. hygrometrica* with which it was compared; differs in being smaller with incurved, more hyaline leaves, the cells with thinner walls.

Both *F. hygrometricoides* Sch. (Mandon, no. 1648) and *F. Mandoni* Sch. (Mandon, no. 1647) have shorter, blunt leaves, with cells more lax and thicker walled, and the vein ending below the apex with the marginal cells more swollen.

PHILONOTIS ASPERRIMA C.M., n. sp. Sorata, 10000 ft. (3140).

Plants small; stems matted with brown tomentum, branches short, less than 5 mm. long, numerous; leaves of two kinds, those of the main stems with a long subulate tip, a dark excurrent vein and serrate, revolute margins, with clear, rectangular cells; branch leaves smaller, the upper part of the leaf very spinose, the vein ending in the shorter, acuminate apex, margins plane or slightly recurved, sharply serrate; lower cells quadrate, smoother and clearer than in the upper ones. Dioecious. Perichetical leaves, broad, hyaline, and clasping at base, with a long subulate apex. Pedicels short, 1 cm.; capsules globose, 1.5–2 mm., oblique, strongly ribbed; lid mamillate, appressed; peristome double, endostome shorter than the teeth, mouth bordered by 4–6 rows of darker denser cells.

Growing mixed with *Bryum argenteum* var. *lanatum* and a

sterile species of *Dicranum* in dense tufts, copiously fruiting. Compared with nos. 11, 13, 14, 17, 18, 20 and 21 of the species listed by Mitten in his Musci Austro-Americani. Most closely related to *P. gracilenta* Hpe., but differing in its smaller size and shorter pedicel.

PHILONOTIS PAGIONIFOLIA C. M., n. sp. Yungas, 4000–6000 ft. 1885 (3139).

Plants forming dense, matted tufts, with little fruit; stems short, branches fasciculate, about 5 mm. long, slender and curved at apex; leaves erect-spreading or secund, narrowly lanceolate, acuminate from a clasping, slightly decurrent base; margins thickened or revolute with several rows of teeth from base to apex; vein thick, excurrent into a toothed subulate apex; cells clear and square at base, all papillose on the upper surface. Dioecious; perigonium broad and clear at base, long-cuspidate at apex; perichetium concave, hyaline at base, ecostate, also with a long serrate tip; both sets of bracts much longer than the stem leaves. Pedicels 20–25 mm. long, bright glossy, orange-colored; capsule 3 mm. long, oblique, strongly ribbed when dry; lid mamillate; peristome double.

Resembling *P. gracilenta* Hpe. (Lindig, New Granada) but the leaves are more blunt. Compared with Mandon's no. 1676 from Sorata, Bolivia, named by Schimper *Philonotis Boliviana*, it differs in its slender and delicate branches, which are less fasciculate. Specimens at Kew are much confused in this troublesome group of species, but ours do not seem to agree with any of theirs. The nearest are those collected by Matthews at Casapi, Peru, in Herb. Hooker, named by Wilson and labelled "No. 2313, *Bartramia uncinata*" (*B. scabrida* Schwaegr. Supp. *pl. 57*), but they differ in the leaves being non-cuspidate and in the large ecostate perichetium.

BARTRAMIA (PLICATELLA) SCORPIOIDES C. Müller. n. sp. Near Yungas, 4000 ft., 1885 (3138).

Plants large, 5–6 cm. high, decumbent and matted with brown tomentum at base, yellowish-green, glossy; stems arcuate, branching by innovations 1–2 cm. long, or fasciculate; leaves secund, uncinate, acuminate, plicate; vein narrow, ending in the carinate serrulate apex, forming a sharp point; cells all papillose, the end walls thickened; dioecious; the antheridia surrounded by broad orange-colored bracts, with serrate papillose tips; perichetial leaves broad, clasping and hyaline, smooth and entire, vein narrow, excurrent into a slender point; pedicels 10–15 mm. long, red, curved at tip; capsules all eaten off or decayed.

Resembling *B. andina* Mitt. in its secund leaves, but when compared with Spruce no. 429 from Pichincha they are quite distinct, our species belonging to the section with *B. arcuata* and *B. scoparia*, but agreeing with neither. The absence of fruit prevents the determination of its closest alliance.

Bartramia tomentosa (Sw.) Mitt. Near Yungas, 4000 ft., 1885 (3136b.) Unduavi, 10000 ft. Oct. 1885 (3136a). Sorata 13000 ft. February, 1886 (3136).

Bartramia (*Breutelia*) *Brittoniae* R. & C. Bull. Soc. Bot. Belg. 31: 161. 1892. Sorata 13000 ft. February, 1886 (3137).

Large plants of a glossy golden green color; stems 6–7 cm. high densely matted with brown tomentum below; capsules few and immature.

Mixed with and resembling *B. tomentosa*, but differing in its squarrose, not secund leaves, which are longer and more sharply acuminate, and serrate.

Bartramia (*Cryptopodium*) *Jamesoni* Tayl. Near Yungas, 4000 ft. 1885 (3134).

BARTRAMIA THRAUSTA Schpr. mss. in Mandon's Plantae And. Boliv., no. 1673. Vicinius Sorata, 3200–4000 m. Mapiri, 5000 ft. May, 1886 (3135) H. H. R.

Plants decumbent and matted together with brown tomentum at base; stems 3–4 cm. high; leaves very brittle, with a conspicuous, white, clasping imbricate base, those of the young branches with a slender twisted apex 3–5 mm. long; older ones all broken off, the white base smooth, the upper part opaque and papillose on the short walls of the cells; margins bordered by 1 row of long yellow cells with small appressed teeth; vein narrow, toothed on back. Dioecious. Perichetial leaves with a short base and long serrate awn. Pedicel curved, 5 mm. long, red; capsule curved, 2 mm. long, with a small orange-colored lid; mouth small; walls ribbed; peristome short, double.

Allied to *B. potosica* Mont., but differing in the longer, less crowded, more spreading leaves with a more conspicuous white clasping base. Named by Dr. Müller for Dr. Rusby but Schimper's name has priority.

BARTRAMIA (VAGINELLA) AURICOLA C. M. n. sp. Ingenio del Oro, 10000 ft., February, 1886 (3135b). Sorata, 10000 ft., February, 1886 (3135a).

Plants light green or brown when old, with numerous, erect,

simple stems, 1–2 cm. long, matted together with brown tomentum at base; leaves 2–6 mm. long, crowded, their white bases imbricated, the green upper part of the blade spreading, much broken, except on the youngest branches; margins finely and sharply serrate, bordered by one or two rows of smooth, elongated, clear cells, those of the blade densely papillose and opaque, vein narrow, keeled and spinose on back. Dioecious, perichetial leaf with a short basal blade only covering the foot and a long rough awn; pedicels short, 3–5 mm. long, pseudo-lateral, straight or curved; capsules large, 3 mm., erect or oblique, strongly ribbed when dry and brown; lid mamillate, appressed; peristome double, teeth, orange-red, trabeculate on the inner face; spores large, .027–.032 mm., rough, brown.

Differing from *B. thrausta* in its smaller size, more strict, erect habit, stouter more rigid leaves. Agrees with Lechler's no. 2680, from Chili, labelled *B. potosica* at Kew, but differs from the type of that species at Paris in the much more conspicuous white base of the leaves.

Bryum Rusbyanum C. Müller. n. sp. Yungas. 6000 ft. 1885 (3148a).

Plants slender, stems erect with short, strict branches, bearing small, erect, lanceolate, serrate leaves, vein disappearing below the apex; stem leaves larger, acuminate with a prominent red vein, also disappearing below the apex. Dioecious; pedicel, 3 cm. long, tawny, capsule pendent, 3–4 mm. long, with a neck half its length; lid mamillate; annulus double, inflated, dehiscent in fragments; mouth with an orange-colored border; cell-walls of exothecium much thickened, peristome double, teeth white, granulose, erose and irregular, endostome also granular with a basal membrane, segments hardly distinguishable from the teeth, neither carinate nor parted, basal rudiments of cilia two; spores large, yellow.

Seemingly a *Dicranobryum* most nearly allied to *D. fusiferum*, Mitt. with the type of which it was compared at South Kensington. Nat. Hist. Museum.

Bryum (*Webera*) *albicans* (Wahlb). Near Valparaiso, Chili, June, 1885 (3145). Antheridial plants only. Sorata, Bolivia, 10000 ft. February, 1896 (3193). Sterile.

Compared with Austin's, No. 189, Musci Appalachiani, these specimens agree perfectly in all the leaf characters, but are a little taller, 3–4 cm. in height.

Bryum candicans Taylor. Sorata, 13000 ft. February, 1886, (3144).

Bryum argenteum L. Near Yungas, 4000 ft. 1885 (3142). Mapiri, 5000 ft. May, 1886 (3142a).

B. argenteum var. *lanatum* Br. & Sch. Mapiri, 5000 ft. May, 1886 (3143).

BRYUM HUMILLIMUM C.M., n. sp. Ingenio del Oro, 10000 ft. March, 1886 (3147).

Plants small, bright glossy, yellowish-green; with julaceous branches less than 1 cm. high; stems red; leaves small, 1 mm. or less, imbricate, concave, those of the young branches obtuse and closely imbricated, the vein dividing and ending below the apex; lower cells lax and enlarged, upper rhomboidal spindle-shaped, forming small inconspicuous teeth. Dioecious. Pedicels short, 5–7 mm. long, darker below; capsules 2 mm. long, pendant; neck nearly half the length, contracted below the spore-sac; lid mamillate, orange-colored, rim red; annulus large, falling with the lid; peristome double, outer of light yellow teeht, papillose outside, trabeculate inside; endostome a shorter membrane with carinate segments, open along the keel, with rudiments of two cilia between.

Closely allied to *Bryum julaceum* Sm., but differing from European specimens at Kew in the shorter more rigid branches, with more closely imbricated leaves and shorter pedicels. Specimens collected by Mandon near Guyaboya, 28th May, 1866, named *B. julaceum*, at Kew, differ in much longer, more slender branches and pedicels 10–12 mm. long.

Bryum soboliferum Taylor. Sorata, 10000 ft. February, 1886. Ingenio del Oro, 10000 ft. (3148).

Compared at Kew with specimens collected by Jameson from Quito, nos. 151–200, and Pichincha, no. 328. Sent to Dr. Müller and with this name, and he replied "forsan species nova."

BRYUM COLORATUM, C. Müller, n. sp. Near La Paz. October, 1885 (3141).

Plants cespitose, in loose light-green cushions; stems with several 4–5 short fasciculate innovations about 1 cm. high; leaves in rosettes at the ends of the branches, 2–6 mm. long, oblong-lanceolate carinate, serrate above the middle, margins bordered by 2–3 rows of elongated cells; vein round, ending in a short mucronate apex; cells all regularly rhomboidal. Dioecious. Perichetial shorter with a longer mucronate tip. Pedicels straight or bent, about 2 cm. high, glossy yellow; capsules nodding, 4–5 mm. long, bright yellowish-brown; neck short, plicate; lid conic-apiculate; annulus compound, falling with the lid; peristome

double perfect, teeth brown, inner membrane deep, carinate segments open along the keel with 3–4 slender, papillose, appendiculate cilia; spores brown .013–.016 mm.

Resembling *B. cernuum* Hedw. in the bright yellow color of its capsules, but a larger and coarser plant, seemingly one of the smaller *Rhodobryums*, with the leaves twisted when dry, allied to *B. andicola*.

Mielichhoferia campylocarpa H. & T. Near Yungas, 4000 ft. 1885 (3150).

Compared with no. 1694 of Mandon's Bolivian mosses, with which it agrees.

Mielichhoferia brevicaulis Hornsch. Near Yungas, 4000 ft. 1885 (3149).

Mielichhoferia n. sp.? Ingenio del Oro, 10000 ft. March, 1886 (3146).

These specimens were compared at Kew with all the species described by Mitten (Jour. Linn. Soc. 12, 320) having leaves at all similar and found to be most nearly related to *M. diplodonta*, but as the fruit is too immature to determine any peristome characters, it cannot be safely referred to any of them. A portion sent to C. Müller was named by him *Mielichhoferia modesta* n. sp.

Rhizogonium spiniforme (L.) Bruch. Yungas, 6000 ft.; Mapiri, 5000 ft. (3151).

POLYTRICHADELPHUS GROSSIDENS C. Müller, n. sp. Yungas 4000–6000 ft. 1885 (3159).

Plants dark red, glossy; stems erect, unbranched 5–6 cm. high, leaves erect, 5 mm. long, closely imbricate with a brown clasping base; margin coarsely serrate; vein pellucid, excurrent into a smooth blunt cusp; perichaetium longer tipped, enclosing long dark protruding paraphyses; Dioecious, the male plants proliferous at apex. Pedicels stout, erect, 2–3 cm. long, bright fulvous, capsules horizontal 4–5 mm. long; lid conic, beak hooked, 2 mm. long.

Compared with *P. rubiginosus* Mitt. no. 211, J. Weir, Andes Bogotenses, pedicels shorter, leaves more sharply dentate; with *P. aristatus* Hpe., no. 2002, Lindig, New Granada, Bogota (1859), and another not numbered, collected in 1863, in the fewer but larger multicellular teeth and short cuspidate apex as well as in the longer pedicels and larger capsules of Dr. Rusby's plants.

Polytrichadelphus umbrosus Mitt. Unduavi, 10000 ft. October, 1885 (3160).

POLYTRICHADELPHUS INTEGRIFOLIUS C.M., n. sp. Unduavi, 10000 ft. October, 1885 (3159a).

Stems 5–8 cm. high, leafless below and tomentose, proliferous at apex; leaves erect, slightly spreading, vein broad, excurrent into a smooth, dark awn; margins entire, incurved; lamellae seven, rows of cells high, uppermost cells rounded in section. Dioecious. Perigonial bracts scarious, with short triangular points.

Male plants only collected, and from the robust stems and broad, scarious, perigonial bracts it strongly resembles *Polytrichum*. Compared with various species of *Polytrichadelphus* at Kew, none of which it resembles.

Pogonatum oligodus Kze. Near Yungas, 4000 ft. 1883 (3157).

Pogonatum tortile Sw. Near Yungas, 4000 ft. 1885 (3158).

Agrees with specimens so named collected by Matthews in Peru.

Polytrichium juniperinum Hedw. Sorata, 13000 ft. February, 1886 (3156).

Polytrichum cuspidigerum Sch. Teste C. Müller. Unduavi, 18000 ft. October, 1885 (3156c).

Plants 5–8 cm. high; stems naked below, densely leafy above; leaves erect-appressed, almost imbricate when dry, 5 mm. long, margins serrate with a few large, coarse, teeth; lamellae filling almost all of the blade, margins only slightly incurved. Perichetial leaves longer, erect, innermost with a scarious base and long, slender tips; pedicel 15–25 mm. long; capsules 3 mm. long with a small hypophysis; teeth lax, short, pale and regular.

No specimens bearing this name can be found in Schimper's Herbarium at Kew.

Polytrichum aristiflorum Mitt. Unduavi, 8000 ft. October 1885 (3155a).

This species has also been collected at Yungas by Pearce There are a great many diverse localities cited for this species by Mitten, and there is as much diversity in the specimens at Kew. We referred all of Dr. Rusby's specimens from Yungas, nos. 3155b and c and no. 3155a from Sorata and 3155c from Mapiri to this species, but Dr. Müller gave it a manuscript name, which is antedated by *P. patulum* Harvey (Müll. Syn. Musc. 1: 210) from Nepaul. It seems probable that there is room for the separation of several species, but as ours agree with Jameson's from the Andes

of Quito and Weddell's from Peru, we have thought it best to enumerate them under this species.

POLYTRICHUM ANGUSTICAULE C.M., n. sp. Near Yungas, 4000 ft., 1885 (3155).

Plants large, 8–10 cm. high; stems simple, 2–4 cm. high; leaves 6–8 mm. long, the clasping base oblong, brown or slightly scarious on the margins, tapering into a slightly longer apex, with incurved entire margins; vein rough on back, with two or three rows of sharp teeth, excurrent into a smooth or only slightly roughened awn; lamellae covering almost all of the blade, of 6–7 rows of cells, the last row elongated, conical and smooth. Dioecious; male plants proliferous; perichetial leaves with a long smooth point; seta 6–8 cm. long, stout, glossy, curved at apex; capsules large, 5 mm. long, cubic, with a short wrinkled apophysis; lid dark red, beak long; teeth white, 64.

Closely allied to *P. aristiflorum* Mitt., and compared with specimens sent us by Wm. Mitten, collected in Venezuela by Funk and Schlim, no. 472. Differs in the longer, scarcely roughened awn of the leaves, which are more closely appressed when dry, and in the larger capsules.

PLEUROCARPI.

All the specimens of the pleurocarpous mosses as well as the acrocarpous ones were carefully studied and separated before duplicates were sent to Dr. Müller, yet in two cases in the genus *Hookeria*, there was evidently a mixture of species growing together, which in one instance seems to have misled Dr. Müller.

HOOKERIA BAKERI E. G. Britton, n. sp. Near Yungas, 4000 ft. 1885 (3163).

Plants yellowish-green, large and coarse; stems 2–3 cm. long; branches 1 cm., leaves curled and crisped when dry, more or less undulate with long subulate tips 2 mm. long, veins prominent when dry, ending just inside the margin, which is entire below, serrulate along the tapering apex and bordered by 3 rows of narrow, elongated cells; those of the blade very large and clear, not papillose. Pedicel 20–25 mm. long, bright, glossy brown; capsules ovoid, 2 mm., brown, walls thick; lid conic-rostrate; teeth long, slender, brown and incurved in pairs, and papillose; endostome yellow, erect, carinate segments closed.

Compared with *H. marginata* to which it is related, but differs in the lighter green leaves, broader and less acuminate, the cells more lax and hyaline.

Dedicated to Mr. J. G. Baker, of the Royal Herbarium at Kew in grateful acknowledgement of the many kind favors received from him while at work, under his charge, on Dr. Rusby's Ferns and Mosses, and also as a small recognition of the task he accomplished in mounting and putting in order the Herbarium of W. P. Schimper, presented to Kew by the Baroness Burdett-Coutts.

This species was first named *H. castanea*, from the description only, and when submitted to Dr. Müller he discovered three new species in it; but as we can find but one specimen in our packet, and have no means of determining which of his names apply to our species, we have discarded all his manuscript names.

HOOKERIA PURPUREOPHYLLA C.M., n. sp. Near Yungas, 6000 ft. 1885 (3164).

Plants small, light reddish brown, .7–1.5 cm. high; stems branched, distichous, or flattened; leaves small, 1 mm. long, closely imbricate, appressed with flexuous, filiform spreading points; veins ending below the rounded part of apex, toothed at the back of the leaf above; margins serrate to below the middle, more coarsely so above; cells papillose, upper wine-color, lower colorless and longer; pedicel purple, 15 mm. long, arched at apex; capsule 2 mm. long; neck tapering; lid conic-rostrate. Peristome not yet matured, torn off with lid.

Compared with *H.* (*Callicostella*) *rufescens* Mitt. (Spruce, no. 629) from which it differs in the longer acuminate leaves; they also are more slender and not so crisped as those of *H. purpurea* and are too acute for *H. incurva*. Our plants are mixed with a small, golden yellow *Hypnum* in fruit, and a brown Hepatic, but we cannot find the two species of *Hookeria*, indicated by Dr. Müller in his letter by two other manuscript names.

Hookeria crispa C.M. Near Yungas, 4000–6000 ft. 1885 (nos. 3161 and 3161a).

Hookeria falcata Hook. Near Yungas, 4000–6000 ft. 1885 (3162).

BRAUNIA CANESCENS Sch. in G. Mandon, Plantae Andium Boliviensium, Exsicc., no. 1641. Vicinius Sorata, 1858, Mandon. Sorata, 10000 ft., February, 1886, H. H. R. (no. 3153).

Plants crowded in brown masses, stems copiously branching, less than 2 cm. high, discolored beneath, green at tips of branches; leaves closely imbricated, lower ones with short white tips, those at the ends of the branches frequently prolonged into flex-

uous white hairs, ovate and quite concave in the middle with a plane border of small square cells in straight rows, and the margins double or recurved, bluntly papillose, frequently brown in the upper half with elongated cells in the centre of the base, and others sinuous; apex serrulate or erose when long and hyaline; perichetium short, 3 mm., enclosing very long paraphyses, bracts strongly plicate, cells long and clear, apex not hyaline; pedicels 1 cm. long, capsules about 3 mm. with small orange-colored mouth and apiculate lid.

Mandon's specimens at Kew in Herb. Schimper are somewhat larger and lighter colored than Dr. Rusby's, but agree in all essential characters, especially no. 1641 of the Exsiccatae in Herb. Hooker. Sent to Dr. Müller as *H. cirrhifolia* (Wils.) Mitt. (J. L. Soc. xii., 406, ex descriptio) and named by him *Braunia argyrocarpa* n. sp., also to Bescherelle, who says, " ut videtur foliis tamen apice diaphanis quod nos indicat Mitten."

BRAUNIA SUBPLICATA E. G. Britton, n. sp. Ingenio del Oro, 10000 ft., May, 1886 (3154); Mapiri, 5000 ft. (3154a).

Plants dark brownish green, in large dense mats, stems decumbent, pinnately branched, often giving off radiculose stolons, branches erect, 4–5 cm. long; leaves subsecund when moist, imbricate and erect when dry, with three blunt ridges, not hyaline pointed, ovate-concave, over 1 mm. long, less than 1 mm. broad, with entire revolute margins and a conspicuously rolled border to the concave center, apex acute and concave, erose dentate, but not hyaline, conspicuously papillose at the tips of the branches, basal cells elongated brown, others regular and sinuous; perichetium narrowly lanceolate, erect, sulcate, 3 mm. long, with oblong yellow cells at base and middle and blunt erose tips; pedicels 1 cm. long, erect or cernuous twisted, fulvous as well as the base of the capsule, which is 2 mm. long with a straight beak over 1 mm. long, mouth with a thick red rim, calyptra brown, 3 mm. long, tufted and ragged at base with a straight beak 1 mm. long.

Differs from *H. plicata* Mitt. (Bridges, Bolivia in Herb. Hooker) in the dull brown color of the plants and in the leaves not being hyaline tipped; from *H. secunda* (Hook. Musci Exot. t. 46, Humboldt's type in Herb. Hooker) in the larger, less secund leaves with more strongly revolute margins; resembling only an unnamed scrap in Herb. Hooker, collected by Mathews in Peru at Casapi, and a part of *Braunia subsecunda* Sch. M. S., no. 5, in Herb. Schimper without locality or name of collecter. (See Jaeger, p. 86) pencilled Mexico? by J. G. Baker. Sent to E. Bescherelle as *B. plicata* Mitt. he says = "? var. *foliis majoribus!*"

Hedwigidium imberbe Sm. Unduavi, 1000 ft. (3152) Sterile. Mapiri, 5000 ft. with 3154a fertile.

Compared with G. Mandon Plantae Andeum Boliviensium Exsicc., no., 1638 vicinius Sorata, labelled *Harrisonia rhabdocarpa* Hpe. with which it agrees. As also with Lindig's New Granada, no. 2000. Both of these are considered to be *H. imberbe* Sm. (Mitt. J. L. Soc. 12: 405). The plants mixed with 3154a are coarser and brighter green, agreeing better with Spruce Musci Am. et. And., nos. 1293–1295, of *H. imberbe*. There is considerable variation in the size and color of this species, also in the degree of ramification of the stems and the appression of the leaves, but otherwise the leaves are indistinguishable when placed side by side under the same cover-glass under the microscope. Weddell's no. 9 Peru, are small, little over 1 cm. high and almost simple like 3152 H. H. R., while Spruce no. 1295 and Rusby's 3154a are nearly 6 cm. high and quite pinnately branched.

CRYPHAEA (EUCRYPHAEA) BOLIVIANA Sch. mss. Mandon (no, 1688), vicinius Sorata, 3200 metr., 1857. H. H. Rusby. Sorata, 10000 ft. 1886 (3165).

Plants large, slender; stems bipinnate, 10–15 cm. long, branches pendant, 5–6 cm. long, branchlets few and distant, 1–1.5 cm. long; leaves spreading when dry, those of the branches 2 mm. long, those of the branchlets only about 1 mm. long, both lanceolate-acuminate, vein ending below the long subulate, serrate apex, margins entire below, slightly recurved in the middle; basal angles auricled, decurrent. Capsules two or three together at intervals along the branches, perichetial leaves with a broad, clasping base covering the capsule, vein scarcely extending below the long nearly smooth awn, exceeding the base in length. Capsules 2 mm. long; peristome double, the outer of long, spreading, broad teeth, the inner of shorter, narrower segments, composed of a double row of papillose cells, attached to a basal membrane.

Allied to *C. pulifera* Mitt., and possibly referable to that species, but recognized also by Müller as a new species, Schimper's name having priority.

Cryphaea ramosa Wilson. Unduavi, 12000 ft., October, 1885 (3166).

Prionodon luteo-virens (Taylor) Mitt. Unduavi, 10000 ft., October, 1885 (3167). Also collected at Yungas and Unduavi by Pearce.

Phyllogonium viscosum Beauv. Near Yungas, 6000 ft., 1885 (3168). Also collected by M. Bang near Yungas, 1890 (565).

METEORIUM (PAPILLARIA) CLADONIELLA C. M. n. sp. Near Yungas, 4000 ft., 1885 (3189).

Plants light yellowish-green, glossy; stems creeping horizontally, 10–12 cm. long; branches simple, 1–3 cm. long; leaves crowded, concave, plicate, appressed, with short spreading points; vein broad at base, or rarely lacking; apex suddenly subulate; margins minutely serrate; cells all papillose.

Plants sterile. Alliance not determined.

METEORIUM LONCHOTRICHUM C. M. n. sp. Near Yungas, 4000 ft. 1885 (3172).

Plants bright yellowish-green, glossy; stems long, creeping; branches irregularly pinnate, 2–3 cm. long; leaves 1–1.5 mm. long, undulate, crisped when dry, lanceolate-acuminate, serrate, vein ending below the apex, cells of the basal angles enlarged.

Plants sterile. Allied to *M. patulum* Sw.

Meteorium filiferum (C.M.) Mitt. Near Yungas, 4000 ft. 1885. (3173).

Plants dark green or black with lighter yellowish branches. Youngest shoots very slender, filform, and totally different in aspect from the older stems; stem leaves, entire, concave, the vein ending below the short recurved cuspidate point; basal angles conspicuously inflated at the inner angle, with a small round group of yellow cells; leaves of the young branchlets much smaller, distant, narrowly lanceolate-acuminate, vein ending below the long filiform point; basal angles decurrent with the same conspicuous round auricle, at the inner point of insertion.

Named from description, and compared with No. 131 collected by Weir, Andes Bogotensis from which it differs in aspect, and the presence of the long filiform branches described in the original.

METEORIUM (PILOTRICHELLA) PERINFLATA C.M. n. sp. Near Yungas, 6000 ft. 1885 (3171).

Plants light yellowish-green, glossy; primary stems 10–15 cm. long, creeping; branches simple, 1–2 cm. long, or with a few short branchlets; leaves concave, the margins so completely incurved as to almost meet, quite entire; vein narrow, ending below the short, sharp-pointed apex; cells of the outer basal angles square, enlarged, slightly auricled and decurrent. Fruiting branches 5 mm. long, perichetial leaves far exceeding the capsules, imbri-

cate, each with a long, squarrose, acuminate apex, with a short vein or veinless. Capsule brown, thick-walled, ovoid, about 2 mm. long, on a short seta; peristome double, teeth long, slender, yellow, endostome as long, carinate segments rarely open along the keel; spores green, .021–.024 mm.

Allied to *M. crinitum* Sull., but differing in the entire leaves and the long peristome, the inner not adhering to the outer Specimens not compared.

METEORIUM (PILOTRICHELLA) REFLECTO-MUCRONATA C. M. n. sp Sorata, 10000 ft., February, 1886 (3170).

Plants light green, glossy; stems creeping and rooting; branches about 1 cm.; leaves imbricate, concave, with reflexed points; vein very short and indistinct; margins incurved, entire, forming a cucullate cuspidate apex; cells of basal angles enlarged, but indistinct, slightly decumbent.

Plants sterile. Alliance not determined.

Neckera Jamesoni Taylor. Sorata, 8000 ft., February, 1886 (3169); Unduavi, 8000 ft., October, 1885 (3169a).

Beautiful plants with pendant branches, often 18–20 cm. long.

Thamnium longirostre (Hook)? Near Yungas, 4000 ft., 1885 (3174a); Sorata, 10000 ft., February, 1886.

POROTRICHUM (THAMNIUM) BOLIVIANUM C. M. n. sp. Near Yungas, 4000 ft., 1885 (3174).

Plants light yellowish-green, with a creeping rhizome; stems 4–5 cm. long, naked below, about 2 cm., bipinnate; branches flattened, frond-like, red; leaves compressed, elliptical-oblong, unequal at base, about 1 mm. long; vein dividing and disappearing below the broad sharply serrate apex; margins entire below; cells of the basal angles only slightly differentiated; monoecious; antheridial buds on different branches from the archegonia; perichetial leaves longer, outer squarrose, subulate, often veinless, inner erect-clasping, with a narrow vein; seta red, flexuous, 10–15 mm. long; capsule 2 mm., ovoid-cylindric, neck short; lid 2 mm. long, with a long beak; annulus large, simple; peristome double, teeth long, slender, endostome of slender papillose carinate segments, open along the keel; cilia none.

Allied to *Porotrichum longirostrum* (Hook.) Mitt. and possibly referable to this variable species, according to Mitten. Compared at Kew with specimens collected by Spruce (And. Quit. nos. 1361–1363) from which ours differ in being much coarser, with less slender, not flagellate branches and shorter stouter pedicels,

agreeing better with Weddell's no. 53 from the Andes of Peru, but our plants are smaller with shorter leaves, turning yellower with age, and more coarsely and doubly serrate at the apex.

Entodon Jamesoni (Tayl.) Mitt. Unduavi, 8000 ft. October, 1885 (3175).

FABRONIA SINGULIDENS C.M., n. sp. Ingenio del Oro., 10000 ft. March, 1886 (3176); Mapiri, 10000 ft. (3182 pp).

Plants in dense pale, yellowish-green mats; stems with numerous short branches 3–5 mm. long; leaves crowded, spreading minute, ovate-acuminate with a long subulate point, margins spinose-dentate or rarely entire at the apex of the branches, vein ending above the middle; basal cells square at the angles. Perichetial leaves broad and serrate at apex, with a suddenly subulate point; vein short. Pedicel erect, 5 mm. long; capsule small, little over 1 mm. long, ovoid; neck distinct, tapering into the pedicel; lid conic-rostrate, small, yellow; mouth small, bordered by 4–5 rows of transversely elongated, darker, denser cells; peristome short, teeth brown when old, pale when young, united in fours or divided when old, smooth, slender at apex.

Closely related to *F. polycarpa* Hook. from which it differs in its abruptly subulate perichetial leaves and its ovate capsule.

HYPNUM (CUPRESSINA) ENTODONTICARPUM C.M., n. sp. Unduavi, 12000 ft. October, 1885 (3186).

Plants in dense, yellowish-green, glossy cushions; stems pinnately branched, arcuate, 1–2 cm. long, branches 5–8 mm. long; leaves crowded, uncinate hooked, entire, veinless; cells of basal angles inflated, yeliow. Monoecious. Perichetial leaves longer, outer uncinate, inner erect, subulate, all veinless. Pedicels red below, twisted above, 15–20 mm. long; capsules erect, cylindric or arched; neck tapering; walls thin; mouth bordered by denser, brown cells; peristome double; teeth brown, short and thick, bordered by the adherent segments of the inner peristome.

Compared with *Drepanium hamatum* Mitt., no. 1046, Spruce Musci Am. et And.), specimens of which are preserved at Kew but are not listed by Mitten. Closely related to this species, but differs in its more clearly veined leaves and longer pedicels.

Leskea aciculata Taylor. Near Yungas, 6000 ft. 1885 (3177).

Compared with Jameson's specimens from Quito with which it agrees.

LESKEA (SCHWETSCHKEA) BOLIVIANA C.M., n. sp. Mapiri, 10000 ft., 1886 (3102). Sorata, 10000 ft., February, 1886 (3185).

Plants in dense yellowish-green mats; stems 1–3 cm. long,

creeping, with short, irregular branches 5–8 mm. long; leaves imbricate with spreading points, ovate-acuminate, less than 1 mm. long; margins entire; vein ending below the apex; cells rhomboidal above, transversely elongated below, not papillose; monoecious; perichetial leaves longer, erect, base long, clasping, vein ending below the acuminate apex; cells elongated; pedicels red, 10–15 mm. long; capsule cylindric, 2 mm.; lid conic; annulus falling in fragments, narrow, single; mouth bordered by darker, denser cells, walls thin; peristome double, teeth long, slender, papillose at apex; endostome with a short basal membrane and slender, carinate, papillose segments, thickened at the joints, or appendiculate; cilia none.

Allied to *L. gracillima* Tayl., which has also been collected in Bolivia by Bridges, but differs in the vein ending below the apex and the leaves being quite smooth. Identical with no. 3185 cited above, which was also sent to Dr. Müller and named by him *Pseudoleskea amblystegiella* n. sp., but this name is too near *P amblystegioides* C.M. from Costa Rica, Polanowsky.

PSEUDOLESKEA ANDINA Sch., mss. Prov. Larecaja, vicinius Sorata, 3200 metr. November, 1857 (1694), legit, G. Mandon "super arbores." Sorata, 13000 ft. February, 1886 (3181). H.H.R. and Unduavi, 12000 ft. October, 1885 (3180)

Plants in dense brown cushions; stems 7–9 cm. long, irregularly pinnate; branches .5–1.5 mm. long, slender; paraphyllia small, clustered, branching; leaves small, less than 1 mm., crowded, minute; base concave appressed, apex subulate, serrulate; vein thick, channelled, excurrent; cells rhomboidal, papillose, those of the basal angles erect, rectangular and denser on each side of the basal folds. Perichetial leaves longer and more acuminate, and not papillose, outer recurved, inner sheathing, all pale and plicate with the vein ending below the apex. Pedicels straw-colored, 2 cm. long; capsules arched, 3 mm. long, slightly contracted below the mouth when dry; lid mammillate; mouth bordered by a deep flaring rim; peristome inserted below the rim, double; teeth yellow, trabeculate; endostome yellow, segments as long as the teeth, carinate, rarely divided or open along the keel, attached to a short, basal membrane, appendaged at the joints; cilia none; spores rough, .016–.021 mm. green.

No. 3181 was named for Dr. Rusby, by C. Müller, but Schimper's name has priority.

Thuidium Peruvianum Mitt. Near Yungas, 6000 ft. (3178), Unduavi, 8000–10,000 ft. October, 1885 (3179).

Compared with Jameson's specimens from Pichincha and Pearce's from the Andes, duplicates of which have been sent to us from Kew. The specimens collected by Miguel Bang (No. 482) at Yungas, and listed by Dr. Rusby (Mem. Torr. Club, 2: No. 3, p. 274) as *Thuxidium delicatulum*, were so named by Mr. C. H. Wright at Kew. Duplicates of all our specimens, including these, were submitted to Dr. George N. Best for critical comparison. He says: "They apparently belong to one and the same species. The stem leaves differ from those of *T. delicatulum* in not being closely appressed when dry; they are more concave, broader at base and more abruptly acuminate, somewhat undulate and rugose above, and the leaf-cells are more rectangular and less rhomboidal. Notwithstanding these differences, which indicate a variety rather than a distinct species, the general type remains well marked. I should refer your specimens to *T. delicatulum*." But as these specimens are much larger and coarser than any of *T. delicatulum* which we have ever seen, and they seem worthy of a distinctive name, we have maintained them as above listed.

SPHAGNACEAE.

Sphagnum Peruvianum Mitt. Near Yungas, 6000 ft., 1885 (3100).

Sphagnum acutifolium Ehrh. Near Yungas, 6000 ft., 1885 (3102), near La Paz, 10,000 ft. October, 1885 (3103).

Sphagnum Meridense C.M. Unduavi, 10,000 ft. October, 1885 (3104).

Sphagnum recurvum Hoffm. Unduavi, 8000 ft. October, 1885 (3106).

Sphagnum recurvum var. *mucronatum* Russ. Near La Paz, 12,000 ft. (3105).

HEPATICAE.

The Hepaticae of the collection were enumerated by Dr. Richard Spruce in Memoirs of the Torrey Botanical Club, 1: 113–140. 1890.

On the Formation of Circular Muskeag in Tamarack Swamps.

CONWAY MACMILLAN.

(PLATES 279–281.)

In 1892 observations made by the writer upon plant-distribution in the valley of the Minnesota led him to recognize and describe what were termed *tension-lines* between groups of plants established in their habitats. In addition to that principal tension between centrally and distally distributed floras arising from what was denoted as *equatorial pressure*, other tensions due to topographic conditions were defined as secondary and as minor tensions. "By the latter term there is not meant the forest and prairie delimitation, for that is to be referred in large part to the principal lateral tension, developed by equatorial pressure. The various topographical features of the Minnesota valley with its gorges, glens, vales, meadows, hills and headlands bring about slight but distinguishable segregations of floral elements. Between meadow and bluff there exists a minor tension-line; between swale and knoll on the prairie, between hill and ravine in the forest, there are to be discovered such minor tensions."* In this paragraph was laid the foundation for a series of studies in the zonal distribution of plants, and much interesting material has since been reviewed. In an extended paper not yet published, but read before the Botanical Society of America at the Buffalo meeting in 1896, and given in abstract in an American journal,† the zonal distribution of plants upon the *roches moutonées* of a fresh-water archipelago and upon lake strand and sand-dune islands was discussed and certain intimate and remarkable connections between physiographic and plant-distributional conditions were indicated.

Zonal distribution was studied in 1893 by Ant. Magnin,‡ who described the *Carex*, *Phragmites*, *Scirpus*, water-lily, pond-weed and *Chara* formations which, by their sequence, mark the increasing depth of the water off shore in the lakes of the Jura. A month or two later *Equisetum* zonal distribution was noted in the

* MacMillan, Metaspermae of the Minnesota Valley, 596, 1892.

† The Botanical Gazette, 22: 218. 1896.

‡ Magnin, A. Recherch. Veg. Lac. du Jura. Rev. Gen. Bot. 5: 241. 1893.

lakes of northern Minnesota* and in the following year numerous papers along this general line were published both in America and abroad. Pieters† adapted the formation classification of Magnin to an American lake and the writer published a short account of two singular floating or anchored atolls of sphagnum which he had observed in central Minnesota.‡ The general facts are well brought together by Warming§ in his recent text-book, although with that too frequent disregard of American investigation which is a blemish to so much European compilation.

Such zonal limnetic formations occur in all parts of the world and afford fine examples of this type of distribution.

At present it is desired to call attention to the tension-line between sphagnum moor and the higher forest-clad ridges surrounding such moors as they exist in Minnesota. Sphagnum formations with the various attendant plants are commonly designated as *Muskeag* by the woodsmen of Minnesota, and the northern half of the State, in particular, furnishes many splendid examples of this type of plant association. The smaller muskeags are quite generally round or approximately elliptical in outline, while the larger ones, although preserving for the most part rounded outlines, are more irregular in shape. They occur abundantly in the neighborhood of the glacial lakes so characteristically disposed throughout the morainic region of Minnesota and are by no means confined to the belt of pines, for they may be observed about Minneapolis, in Chisago county and in the middle western counties of the State. Unlike the more ancient lakes of western Ontario and the international boundary region between Minnesota and Canada, these lakes have the typically rounded form of a glacial basin and rarely imitate in outline the long, rock-bound and irregular bodies of water so omnipresent in northern Canada.

The sphagnum moors or muskeags may be regarded as such glacial ponds or lakes in process of conversion to forest, and almost every imaginable transition may be found, from open lakes with

* MacMillan, C. Shore formation of *Equisetum limosum*. Bot. Gaz. 18: 316 1893.

† Pieters, A. J. The Plants of Lake St. Clair. Pamph. 1894.

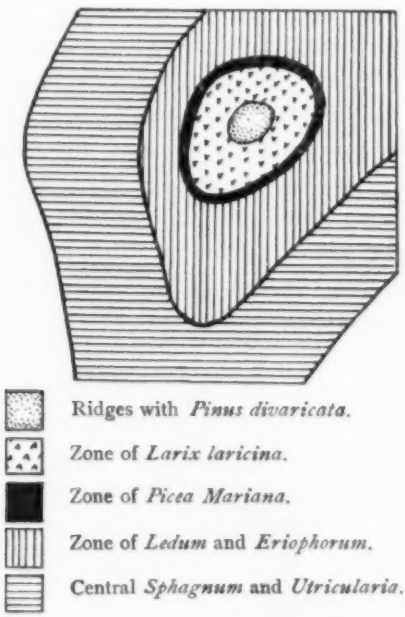
‡ MacMillan, C. On the Occurrence of Sphagnum Atolls in Central Minnesota. Minn. Botan. Studies, 1: 1. 1894.

§ Warming, E. Lehrbuch der Oekologishen Pflanzengeographie, 162. 1896.

sandy beach-lines continuous on all sides—a testimony to the untrammelled action of the waves—to solid masses of spruce and tamarack timber. The latter is displaced again by pines or hardwood and is converted eventually into mixed wood or perhaps even into meadow.

Typical muskeag with spruce and tamarack may clearly be taken as an intermediate physiognomic distribution of vegetation, linking the original open lake with the later glade or forest. A description of such an area may be given briefly and reference to the plates accompanying this paper will indicate clearly enough what relation the different plants bear to each other.

The center of the muskeag is ordinarily softer and more yielding than the edges, although this is not true of older specimens of


Ridges with *Pinus divaricata*.
Zone of *Larix laricina*.
Zone of *Picea Mariana*.
Zone of *Ledum* and *Eriophorum*.
Central *Sphagnum* and *Utricularia*.

the formation. In them, and in many of the small muskeags, the center is quite as firmly filled with soil as the circumference. Towards the center of those younger muskeags, which will be considered as typical, there is a preponderance of the sphagnum. If the very center is occupied by an open pool, this is usually covered

with *Utricularia*, *Lemna trisulca*, or even pond-weeds and water-lilies. Farther from the center *Kalmia* and *Andromeda*, with such orchids as *Pogonia* and *Limodorum*, various species of *Carex* and *Eriophorum*, *Sarracenia*, *Salix*, *Vaccinium*, *Schollera* and kindred plants establish themselves. *Ledum* commonly affects drier and more peripheral positions, and is often the most abundant heath when the sphagnum has disappeared, except from isolated patches among the tamaracks. Surrounding this group of plants, herbaceous and shrubby, many of them with the pronounced xerophytic characters of sphagnum-moor inhabitants, are frequently spruces—either *Picea Canadensis* or *Picea Mariana*, but ordinarily the latter—tamaracks (*Larix laricina*) and sundry species of *Salix*, with *Alnus incana* and dwarf *Betulas*.

A very perfect series of muskeags, uninjured by fire or lumbering operations, occurs in the vicinity of Grand Rapids, Minn. I have been able through tne kindness of Mr. W. W. Pendergast, Director of the State Experimental Sub-Station at that point, to secure photographs of two of these moors, taken in such a way as to bring out the zonal distribution of the tamaracks and spruces. The general ridge group of plants in this region may be described briefly as forests of *Pinus divaricata*—the "Jack Pine" of the loggers. It is this tree which occupies the ridge in the background of Plate 279, to the left. Here and there in the valleys the muskeags are situated, each surrounded and, as it were, marked off from the pines by a circle of tamaracks. In the particular muskeag from which Plate 279 was taken the open area is almost elliptical in shape and contains about 1250 square rods. The ring of tamarack varies in width, but is estimated as about 75 yards across at the point shown. Where it faces the moor it is lined with black spruce. Small spruce trees are scattered out into the moor and a *Salix* shrub is seen in the foreground. The spruces nearest the open part of the moor are both smaller and younger than those farther back, although it must be observed that the difference in age is somewhat less than is indicated by the difference in size. Those growing out in the colder water and lighter peat soil are dwarfed in consequence. In this muskeag the principal accessory plants are *Andromeda*, *Chamaedaphne*, *Kalmia* and *Ledum*.

The following measurements and determinations of the age of trees in the muskeag and in its border-line were secured for me by Director Pendergast.

Tree.	Distance in rods in from border-line.	Diameter, inches.	Height, feet.	Age, years.
Spruce	0	5.5	28	49
Spruce	3	1.25	5	15
Spruce	6	4	17	38
Spruce	6	2	8	21
Spruce	6	2	8	21
Tamarack	0	7	30	55
Tamarack	2	2.5	12	45
Tamarack	10	1.25	6	18

Mr. H. B. Ayres, who has studied the habit of spruces growing in muskeag,* but publishes no comparative measurements, assures Director Pendergast that in cold bogs he has found black spruce little more than an inch in diameter and seventy-five years of age. A consideration of the table above will indicate, however, that the older trees are in general banked near the edge of the moor, while the trees that have pushed out into the moor, though much older than they appear, are actually younger than the individuals of the border-line.

The muskeag shown in Plates 280 and 281 is upon the Experiment Station grounds at Grand Rapids. The view shown in Plate 280 was obtained with the camera placed nearly under the trees of the opposite side and looking towards the northwest. Plate 281, taken from the same position, looks slightly southwest, and the two together give a very intelligent idea of the actual size and shape of the moor. In Plate 280, especially, the sharp demarcation between the zone of spruces facing the moor, and the zone of tamarack just behind is well brought out. *Eriophorum*, which did not appear in Plate 279 (the white flowers here being probably *Limodorum*), is abundant in the other two views and with *Carex*, *Ledum* and *Vaccinium* forms the principal secondary vegegation, the sphagnum being regarded as the primary group. Plate 281 shows tamarack facing the moor to the left, and spruces, with tamarack behind, to the right.

* Ayres, H. B. The Muskeag Spruce. Gard. and For. 7: 504. 1894.

An examination of the three views of the moors suffices to convince anyone that in the same sense that zones of *Carex*, *Phragmites*, *Scirpus*, *Nymphaea*, *Potamogeton* and *Chara* are described as characteristic of the limnetic distribution in the lakes of the Jura or elsewhere, so also are zones of *Larix*, *Picea*, *Ledum*, *Andromeda* and *Utricularia*, characteristic of the filled lakes or moors of Minnesota. It is scarcely worth while to designate the zones as *Laricetum*, *Picetum*, etc., for an indefinite number of such names might be found necessary in different parts of the world.

Certain points that have been touched upon might rightfully claim a more extended discussion. The presence of the spruce between the tamarack and the moor is peculiarly interesting. Large numbers of these muskeags form no spruce ring at all. This is especially true of those towards the southern limits of the formation, as for example near Minneapolis, which is south of the black spruce belt in Minnesota. In such cases the tamarack trees themselves stand facing the moor, and the transition is through *Salix*, *Cornus*, *Ilex* and kindred shrubby plants. A number of views illustrating this type of tension-line between moor or meadow and tamarack swamp have been obtained and may be published later. Apparently the exact habitat offered outside the sphagnum and inside the larch zone is seized upon by spruces, and they establish themselves where the water is too cold or the soil too thin for the tamaracks to flourish.

Cedar swamps offer a number of ecologic conditions that can not be entered upon here. Combinations of cedar and spruce in the tension line surrounding muskeag are met with. Their study is deferred until later.

In the case of the spruce trees established in their zone peripheral to the *Ledum* formation, the gradations in size connected as they are, under the reservations made above, with gradations in age, indicate that the tamarack and spruce rings are slowly closing in upon the central formations and should eventually occupy the whole area of the moor to the exclusion of those plants which flourish in the open. As a matter of fact, such circular or elliptical tamarack formations, solid clear to the core, are frequent in southern Minnesota, while in northern Minnesota a slight variation arises from the ordinary presence of a small central group of

spruces in such formations. Such tamarack swamps with central spruces are well developed in Cass county, Minnesota, especially in the vicinity of Gull lake, where I have studied them.

In any given instance it is apparent that several considerations should enter into a judgment concerning the probable origin of a solid or spruce-centered formation of tamarack. If the formation be a small one it may properly be questioned whether a stage with central moor had ever intervened. Furthermore, the contour of the bottom and depths of water in the original pond or lake would always have to be regarded in any generalization. For example, I have convinced myself that in some cases successions of muskeag openings with intervening tamarack arise from the filling of a lake with bars or reefs upon the bottom, the original positions of which is perpetuated by the lines of larches. Had the slant in the lake been strongly off-shore and the pond been deep in the middle a moor might then have been established at first with open water in the center, and only after a long lapse of years could the trees have crept out upon the peat. Had, on the other hand, the slant been slight and the pool sufficiently shallow at the center it might probably have filled without passing through any moor stage. Therefore some, at least, of the circular tamarack swamps with or without spruce cores could scarcely be regarded as necessarily derived from moors with tamarack or tamarack and spruce border-rings. This would, on the other hand, not hold true of all, and a consideration of the size and age of the trees from circumference to center will indicate that many of the solid tamarack swamps must have developed by this process of closing in a ring of timber upon a constantly diminishing moor.

Exceedingly pretty examples of the dispersion and obliteration of plants by such movements of tension-lines as here described may be observed. After the tamarack formation has become solid the sphagnum often manages to persist in little clumps and mats at the bases of trees where considerable rain water is drained into a small area by the tree trunk with its radiating branch system above. *Sarracenias*, *Vacciniums*, *Empeliums*, the dwarf cornel and other moor plants continue thus among the trees. The *Eriophorums*, *Salices* and many others do not seem to find the shade so grateful and commonly disappear altogether from the formation.

It will be noted that various generalizations upon the zonal distribution of plants might be based upon such facts as have been given above. Indeed it would seem that there are two principal types of plant arrangement in their habitats. These are: (1) Zonal and (2) Azonal. The first is connected either with environmental conditions as a principal factor, as in the case of the zonal distribution upon dome-shaped islands, upon *roches moutonées*, and on a larger scale upon mountain peaks and isolated ranges, along lake or ocean strand, and surrounding moors, or it may depend more particularly upon the character and habits of life of the plants themselves, as, for instance, in the care of the "fairy-ring" fungus. The matter may be summed up in a sentence. *Generally when there is well-marked radial symmetry in the topographic feature upon which a group of plants is distributed zonal arrangement is the response of the plant population to these symmetrical physiognomic conditions; but when the topographic feature is devoid of such well-marked radial symmetry the plants dispose themselves according to the azonal type.* Talus-heaps, flat extended meadows, highly irregular hills, shallow marshy ponds and other such localities may serve as illustrations of asymmetrical habitats. A variety of conditions determine whether the distribution upon a given area be zonal or azonal. And it is worthy of note that the same formation may in one case arise by zonal, in another by azonal distribution. This was brought out in the discussion of circular solid tamarack formations upon a previous page.

The contemplation of vegetation in any region with these principles in view is certainly illuminating. Practically it connects at once ecologic distribution with physiography, and enlarges the content both of topography and of botany.

Description of Plates.

Plate 279. Muskeag near Grand Rapids, Minn., showing the pine-covered ridge in background, and zones of tamarack, black spruce and *Ledum* in the foreground.

Plate 280. Muskeag near Grand Rapids, Minn., showing spruce zone against the tamarack, and a central moor with *Eriophorum*. Looking northwest.

Plate 281. Same muskeag as in Plate 280. On the left tamarack faces the moor; on the left the black spruce formation intervenes. The vegetation in the foreground is *Andromeda*, *Eriophorum*, *Carex* and sphagnum.

Plates all from photographs obtained for the author by Director W. W. Pendergast, of the Grand Rapids Experimental Sub-station, 1896.

The North American Species of Agrimonia.

By Eugene P. Bicknell.

(Plates 282, 283.)

Perhaps no one of our long-known plants has more effectually escaped a right understanding by botanists than the familiar Agrimony of the Eastern States, long current in local floras and text-books as *Agrimonia Eupatoria* L. This name, it seems, has been doing duty since the beginning of American botany for a considerable *group* of related species, of which at least five may now be clearly recognized. Nor is this all; for, as first shown by Dr. Britton (Bull. Torr. Club, **18**: 366, 1891), the true *Agrimonia Eupatoria* is not known at all as an American plant and is very distinct from that particular one of our native species which has been more especially referred to it.

For the initial fault in this misunderstanding we must go back to "Species Plantarum," wherein, under *A. Eupatoria*, we find the citation "Gron. Virg.," although the inconsistency follows that the species is attributed to Europe only. Walter seems to have been the first of our writers to adopt the name definitively into the American flora (Fl. Car. 1788), though it is not now possible to determine the exact sense in which he used it. And so with most subsequent authors the name as used has doubtless a composite significance, though mainly intended to designate our most common and generally distributed species.

Muhlenberg appears to have been the first to perceive that this plant was not identical with the European and he gave it its first distinctive appellation—*hirsuta* (Cat. 47, 1813). Muhlenberg, indeed, seems to have better understood our group of species than any subsequent writer except Wallroth, although he has been quite overlooked, and his name *hirsuta*, for our representative species, which it now becomes necessary to adopt, was afterwards independently used by Torrey for a more hairy form of the same plant.

The genus *Agrimonia*, with especial reference to the North American species, may be characterized as follows:

AGRIMONIA L. Sp. Pl. 448. 1753.

Perennial, erect or assurgent, mostly glandulose herbs, simple or branched above, with alternate, conspicuously stipulate, odd-pinnate leaves bearing interposed subleaflets, and small regular perfect yellow flowers in spicate racemes. Flowers short-pedicelled or subsessile, axillary from small 3-cleft bracts and with a pair of trifid or entire bracteoles at the base of the calyx. Calyx-tube in fruit obconic, turbinate or hemispheric, short-stipitate, sulcate, uncinate-spinose or bristly above, contracted at the throat to form a flattened or convex disk which supports a central process formed by the five connivent calyx-lobes. Petals 5, inserted with the 3–15 stamens in the margin of a waxy disk which surrounds the terminal styles in the throat of the calyx; anther-cells mostly separated by a broad connective. Carpels 2, included, developing into one or sometimes two one-seeded achenes with membranous testae contained in the indurated calyx tube, seeds suspended.

Leaflets crenate, dentate, serrate or incised, the teeth mucronulete or having a minute callosity in the tip. Lower stipules smaller and simpler than those above. Stamens variable in number in the some species, often fewer than normally in the terminal or later flowers. Roots either fibrous or tuberous-thickened.

The North American species, as far as known, are as follows. The ranges given are based alone on specimens actually examined, and are doubtless subject to considerable extension in some cases.

1. AGRIMONIA HIRSUTA (Muhl.).

A. Eupatoria of most American authors, not L.

A. eupatoria hirsuta Muhl. Cat. ed 1, 47. 1813.

A. Eupatoria β hirsuta Torr. Fl. 473. 1824.

A. gryposepala Wallr. Beitr. 1: 49. 1842.

New Brunswick to Minnesota and Nebraska, south to North Carolina; California.

2. AGRIMONIA STRIATA Michx.

A. striata Michx. Fl. Bor. Am. 1: 287. 1803 (*fide* T. & G.).

A. eupatoria β glabra Muhl. Cat. ed. 1, 47. 1813.

A. parviflora DC. Prodr. 2: 587, excl. Aiton. Not Soland. 1821.

A. Eupatoria δ parviflora Hook. Fl. Bor. Am. 1: 197. 1830.

A. microcarpa Wallr. Beitr. 1: 39. 1842.

A. rostellata Wallr. Beitr. 1: 42. 1842. ="*A. americana* Luca in herb." Wallr. loc. cit. as syn.

Southeastern New York, and doubtless Connecticut, to Virginia, west to Missouri.

3. AGRIMONIA PUMILA Muhl.

A. pumila Muhl. Cat. ed. 1, 47. 1813.

Pennsylvania and Maryland to Florida, west to Kentucky and Louisiana.

4. AGRIMONIA MOLLIS (T. & G.) Britton.

A. Eupatoria γ mollis T. & G. Fl. 1: 431. 1840.

A. platycarpa Wallr. Beitr. 1: 38. 1842. ="*A. Eupatoria americana* Beyrich in Herb." *fide* Wallr. loc. cit.

A. pubescens Wallr. Beitr. 1: 45. 1842. ="*A. parviflora* Kinn in Herb." *fide* Wallr. loc. cit.

A. mollis Britton, Bull. Torr. Club, 19: 221. 1892.

Southeastern New York, and doubtless Connecticut, to Michigan, south to Georgia, Tennessee and Kansas.

5. AGRIMONIA BRITTONIANA n. sp.

New Brunswick and Quebec to western New York and doubtless further north and west, south to Ulster and Westchester counties, N. Y., and along the Alleghenies to West Virginia; Montana; Laramie Peak, Wyoming and, either this or an allied form, in Arizona and New Mexico.

6. AGRIMONIA PARVIFLORA Soland.

A. parviflora Soland. in Ait. Hort. Kew. 2: 130. 1789.

A. Eupatoria Michx. Fl. Bor. Am. 1: 287. 1803, chiefly, *fide* T. & G. Not L.

A. suaveolens Pursh, Fl. 1: 335. 1814.

A. serrifolia Wallr. Beitr. 1: 40. 1842. ="*A. Eupatoria americana* Kinn in herb." *fide* Wallr. loc. cit.

Southeastern New York, and doubtless Connecticut, to Illinois and Missouri, south to Georgia and Mississippi.

7. AGRIMONIA INCISA T. & G.

A. incisa T. & G., Fl. 1: 431. 1840.

Florida, Alabama, Georgia, South and North Carolina.

Key to the North American Species of Agrimonia.

Leaflets serrate, dentate or crenate with numerous teeth.

Racemes and leaves beneath glabrous or with loose spreading hairs.

Roots not tuberous; fruit large, turbinate, with numerous radiating bristles. 1. *A. hirsuta.*

Roots tuberous-thickened; fruit very small, hemispheric, with few ascending or erect bristles. 2. *A. striata.*

Racemes and lower surface of the leaves closely or softly pubescent.
Roots tuberous; stems pubescent; leaflets not glandular-dotted beneath.
Small or simple, with elongated terminal raceme, leaflets 3–5.
3. *A. pumila.*
Larger, branched, leaflets 5–11. 4. *A. mollis.*
Roots not tuberous; stems hirsute; leaflets glandular-dotted beneath.
Leaflets 5–9, oblong or rhomboid; fruit large, the bristles connivent,
5. *A. Brittoniana.*
Leaflets 9–23, lanceolate; fruit small, the bristles radiate.
6. *A. parviflora.*
Leaflets incised with few salient teeth. 7. *A. incisa.*

1. AGRIMONIA HIRSUTA (Muhl.).

Commonly 3°–4° tall (2°–6°), simple, to loosely wide branched above, minutely glandulose and somewhat viscid on the branches, aromatic. Stem usually zig-zag from leaf to leaf, villous-hirsute with slender spreading hairs. Leaves bright green, large, 4′–12′ long, 3′–8′ wide, the villous leaf-stalks usually with short petiolar portion. Leaflets large, rather thin, commonly three pairs (2–4 pairs), elliptic, broadly oblong or obovate-oblong, acute, sessile or subsessile, often with rounded or subcordate base, the odd leaflet short-stalked or subsessile with narrowed base, coarsely serrate with acute or somewhat rounded mucronulate teeth, the margins ciliate-fringed, upper surface glabrous or with short, scattered, appressed hairs, lower surface minutely, often sparsely, pulverulent-glandulose and with scattered hairs on the larger nerves, rarely subpubescent. A frequent size of the leaflets is abo ut 2½′ × 1¼′, an extremesize 5′ × 3′. Interposed leaflets normally three pairs in the distal interspace, fewer or smaller in the lower interspaces, the middle pair much the largest, ovate or obovate from a broad base, acutely lobed, often subopposite, in weak plants sometimes much reduced, rarely to a small entire pair. Stipules normally very large, sometimes over an inch broad, the pairs cordate-amplexicaule, often overlapping around the stem, openly cut-serrate or dentate-lobed in the rounded outer margin which is abruptly contracted into the ovate-acuminate incurved terminal lobe. In reduced plants the stipules are smaller and narrower, the lowermost sometimes entire. Branches openly compound, widely spreading or loosely ascending, bearing spreading racemes. Racemes commonly under a foot in length (4′–16′), often inclined in fruit, minutely pulverulent-glandular and thinly spreading-villose, somewhat closely many-flowered or the lower flowers distant on slender ascending pedicels 2″–5″ long, the uppermost sometimes subverticillate clustered. Bracts relatively large, the narrow lobes ciliate-fringed, often exceeding the flowers at anthesis; bracteoles lanceolate-attenuate, nar-

rowly 3-cleft or entire. Flowers 4″–6″ broad, bright yellow; anther-cells separated by a distinct connective; flower buds ovoid, narrowed to a prominent point, minutely glandulose. Mature fruit reflexed, large, 3″–6″ long over all and as wide across the bristles, short-turbinate, mostly contracted abruptly to the stipitate base, strongly fluted, pulverulent-glandulose, often slightly strigose at the extreme base; bristles numerous, spinose, loosely covering the convex disk, the lowermost reflexed from the prominently expanded margin of the disk, those above spreading and erect, the innermost slightly exceeding the acute beak-like calycular process and at least half the length of the fruit. The mature calyx-lobes taper into rigid, minutely hooked points which are finally incurved together, a feature which Walroth recognized by his name *gryposepala*. The roots are fibrous, often slightly thickened throughout their length, but never tuberous. They are not fragrant as those of the European *A. Eupatoria* are said to be. (Plate 282, fig. 1.)

Borders of woods and thickets in sun or half shade, growing in vigorous groups or sometimes scattered.

Begins to flower at New York in the first week of July, two or three weeks in advance of any other species, and ceases to flower in August, also earlier than any of its congeners. The date of first flowering has ranged in nine years from June 29 to July 10.

The young herbage, when crushed, exhales an agreeable fragrance which somtimes even suggests that of the Japanese Honeysuckle.

It may be noted that the name *hirsuta* of Muhlenberg now adopted for this plant displaces *hirsuta* of Bongard for a Brazilian species.

2. Agrimonia striata Michx.

Slender, commonly 1½°–2½° high (8′–5°, simple to delicately paniculate-branched, minutely glandulose nearly throughout, viscid above and in the racemes, agreeably aromatic. Stem glabrous or with scattered spreading hairs (sometimes thinly hirsute at the base, and rarely finely subpubescent above), the slender leafstalks thinly hairy-pubescent to glabrate, scabrous on the lower side. Leaves rarely reaching nearly the extreme size of those of *A. hirsuta*, but usually much smaller. Leaflets sessile or subpetiolulate or the odd leaflet on a slender, sometimes foliolate stalk, commonly two pairs (1–4 pairs, the larger number occurring only rarely and on the lowest leaves), thin, glabrous or nearly so

above, below sprinkled with pellucid glandules and sparingly hispidulous on the larger nerves, the margins subciliate. The leaflets are somewhat variable in form, but are commonly blunter and more obovate-cuneate than those of *hirsuta*, with broader, less acute teeth, the marginal pattern mostly coarsely crenate-dentate to boldly crenate; sometimes they are throughout narrowly obovate-oblong with broad, shallow, semicrenate teeth; on the reduced often trifoliate upper leaves they may be very narrow and sharply dentate-serrate. Interposed leaflets elliptic to obovate, acute, often confined to the distal interspace, usually a small or minute entire pair, occasionally larger and dentate-lobed, rarely with a minute pair on either side. Stipules smaller and narrower than in *hirsuta*, rarely becoming ½′ wide, often very small, lanceolate to semi-cordate, cut-serrate to deeply incised, the lowest often entire. Inflorescence varying from a short terminal raceme to a delicately branched nearly naked loose panicle, the glandulose racemes only 3′–6′ long and rather loosely flowered. Flowers very small, 2″–3″ wide, pale yellow, on slightly spreading pedicels 1″ or less long; anther-cells contiguous. Bracts minute, ciliolate; bracteoles ovate, 3-lobed or entire. Flower-buds subglobose, almost truncate, the sepals ovate-oblong, obtuse, downy-canescent within the apical margins. Mature fruit subspreading or nodding, very small, 1″–1½″ wide, the body subhemispheric, 1″ long below the marginless rim, pellucid-glandulose, bristles few and weak, short, erect and slightly spreading, equalled or exceeded by the truncate calycular process which caps the very tumid disk; sulcae rather broad and shallow, converging into the narrow and curved stipe-like base. Roots developing tuberous thickenings which reach a size of 3′ × 2″; elongated roots sometimes show two or three successive swellings. (Plate 283, fig. 6.)

Hilly woodland, mostly in light rich soil; of scattered growth, or forming loose colonies, but never massed in close groups.

Begins to flower at New York from about the middle to the end of July and continues to bloom into early September.

This species need be compared only with *A. hirsuta* which, in its stouter forms, it sometimes closely resembles. It differs most obviously in its tuberous roots, lesser size and more slender habit, nearly glabrous stem and branches, delicate short racemes, smaller flowers with obtuse sepals, much smaller hemispheric fruit with unmargined disk and few mostly erect bristles, smaller narrower stipules and more crenate leaves. The leaves, generally fewer than in *A. hirsuta*, are more obovate in general outline, the more slender leafstalk rougher below and more narrowly and deeply grooved along the upper side, the leaflets mostly more obversely broadened

and rounded at the apex, the pairs separated by wider intervals, the lowest pair relatively much smaller, the interposed leaflets much less developed, the petiolar portion of the leafstalk longer. In its earlier stages the inflorescence is strikingly different from that of *hirsuta*. In the latter the longer and stouter villous racemes are closely flowered and conspicuously bracteose; in *striata* the delicately slender rearly glabrous racemes are more viscid-glandular and much less closely flowered, with minute inconspicuous bracts and rounded-truncate instead of pointed flower buds.

In adopting the name *striata* for this species I have simply followed Dr. Gray who, having seen Michaux's material, cites the name as a synonym, not of *A. Eupatoria*, but of *A. Eupatoria* var. *parviflora* of Hooker, the plant here taken up, giving to the reference his mark of authentication. (T. & G. Fl. loc. cit.).

3. Agrimonia pumila Muhl.

The smallest of our species, 1°–2° high, erect or more slender and assurgent, simple or with a few ascending branches from the lower part of the elongated terminal raceme. Stem clothed with loose often coarse pubescence and hirsute with spreading hairs which become subappressed above and obsolete in the pubescent racemes. Leaves often crowded low on the stem, often trifoliate, small, 1½′–3½′ long, 1½′–2½′ wide, the upper ones much reduced. Leaflets firm, 1–2 pairs, the lower pair always small, oval to obovate or the odd leaflet cuneate, sessile or subpetiolulate, obtuse or rounded at the apex or sometimes acute, crenate or dentate or sometimes boldly crenate-dentate, commonly 1′–1½′ long, dark-green above and loosely appressed-hairy to nearly smooth, the margins loosely appressed-ciliate, paler and softly pubescent below, pilose-pubescent or hairy along the veins, obscurely, if at all glandulose; leafstalk villous; subleaflets wanting or a minute pair, entire or few-dentate. Stipules small, the main pairs rounded and cordate-clasping, acutely dentate-lobed or incised, sometimes dentate on the inner margin. Racemes loosely-flowered, often remotely-flowered below. Flowers small, the buds subglobose. Fruit small, 2″ long, 1″–1½″ wide, turbinate or subhemispheric, minutely glandulose, often canescent in the sinuses when young, the disk mostly obscurely margined and rising to the short and broad calycular process, the bristles loosely ascending and erect. Roots developing short tuberous thickenings. (Plate 283, fig. 5.)

This species is nearly related to *A. mollis* and occasional depauperate plants of the latter are with difficulty distinguishable

from it. I think there can be no doubt, however, that the two species are distinct and that a comparative study of growing plants would disclose more pronounced differences than dried specimens have revealed. The uniformly small size and simple or nearly simple habit of *pumila* and its slender and elongated loosely-flowered raceme are usually sufficient to distinguish it. The pubescence seems to be generally coarser and more hirsute than in *mollis*, and the much smaller, mostly trifoliate leaves more crowded on the lower part of the stem and apparently of thicker texture. I have not seen satisfactory material in mature fruit. The range of the plant is clearly more restricted northward than that of *mollis*, and more extended southward as far as at present known.

I adopt Muhlenberg's name *pumila* for this species with some hesitation and only to avoid the alternative of conferring a new name. Muhlenberg characterized his plant by the one word "little" and gave its habitat as Mississippi. Applying the rule of exclusion it would appear that only this species could have been intended. If it should be found that *A. mollis* extends into Mississippi the name would have only a dubious claim to availability.

4. AGRIMONIA MOLLIS (T. & G.) Britton.

Not aromatic and obscurely if at all glandulose, mostly slender and 2°–3° high (1° to over 6°), the branches ascending or sometimes spreading, either few and simple or forming a loose panicle which exceptionally attains a spread of as much as 2°–3°. Stem below loosely tomentose-pubescent and weakly villose with spreading or subspreading hairs, becoming finely hoary-tomentose or subappressed pubescent above and in the racemes. Leaves rather dark green, 3′–12′ long, 2′–7′ wide, a common size being 5′ or 6′ by 3′ or 4′. Leaflets commonly 2 or 3 loosely separated pairs (1–4 pairs), mostly obovate-oblong, varying from obovate to elliptic, subsessile, rounded or somewhat acute at apex, dentate-serrate to crenate, the odd leaflet mostly obovate, often on a foliolate stalk, reaching an extreme size of 4½′ × 2′, the largest lateral leaflets becoming 3′ × 1½′; upper surface sparsely hirtellous-pubescent and roughish to glabrate, the margins finely subappressed-ciliate, lower surface paler and minutely downy to velvety-pubescent; leafstalk finely pubescent and somewhat tomentose-villose. Stipules varying from small, lanceolate and entire on the lower leaves and in dwarf plants to cordate-clasping with cut-serrate or incised

outer margin, on stout plants sometimes 2′ long by 1′ wide. Interposed leaflets often only a small entire pair in the distal interspace, sometimes larger, obovate-oblong and dentate above with a single minute one or a pair on either side. Racemes slender, mostly 5′–10′ long, rarely 16′, rather loosely flowered. Flower-buds rounded, scarcely or not at all glandulose. Flowers 3″–5″ broad, rather deep yellow; anthers with broad connective. Bracts and bracteoles pilose-ciliate, very small, at least the bracts narrowly 3-cleft. Fruit before maturity oblong and ascending, later reflexed or subspreading on short appressed pedicels, minutely subglandulose and slightly strigose, small, 2″–2½″ long, 1½″–2″ wide, narrowly turbinate to subhemispheric, often with a somewhat narrowed nonsulcate basal portion, or the lowest fruit of the racemes sometimes depressed-turbinate, marginless or obscurely margined, the disk flat or slightly convex with obtuse sepaline process, bristles loosely ascending or closer and nearly erect, equalling the body of the fruit or only half its length. Roots tuberous-thickened as in *A. striata*, but the swellings often thicker and less tapering at either end, often club-shaped. (Plate 282, fig. 3.)

Dry open woods and copses and weedy banks and hillsides. Of scattered or solitary habit of growth.

Begins to flower at New York from the middle to the end of July and blooms later than any other species; belated flowers are sometimes to be found at the middle of October.

Reduced plants are sometimes trifoliate nearly throughout and simulate *A. pumila*. It will be usually evident to the collector of such forms, however, that they represent a state of imperfect development under unfavorable conditions of growth.

This is the most variable of our species and runs into several unstable forms. It should not be overlooked, however, that it shows a well-defined tendency to separate into two particular forms or varieties. Extreme examples of both are common and exhibit so considerable a degree of divergence that the eye always gives them instant recognition. Although both varieties are to be found holding their characters perfectly under identical conditions of soil and situation, intermediate forms, or what appear so to be, are of such frequent occurrence that I have not been able to satisfy myself of the expediency of giving a distinctive varietal name. For the sake of definiteness, however, the foregoing description of *A. mollis* has been made to cover only the form represented by the type, a specimen of which is preserved in the Herbarium of

Columbia University ("Red River, Dr. Pitcher"), excluding its variety, which may be separately characterized as follows:

Pubescence throughout denser and more pilose than in the type, the smaller and narrower leaves dull grayish green, the leaflets much narrower and dentate rather than crenate, the pairs closer and often more numerous. The hairs of the stem are longer and weaker than in the type and often loosely appressed, the pubescence above tending to become dense and pilose-canescent. The leaflets are mostly 4 pairs, though often 5–6 pairs on the narrowed lower leaves, narrowly-oblong (linear- or lanceolate-oblong) to elliptic, often inequilateral and backwardly subfalcate, blunt or subacute, abruptly narrowed or rounded at the sessile base, mostly dentate or dentate-serrate, often with broad, shallow, uneven teeth, the odd one mostly sessile, or when petiolulate frequently cleft basally into a pair of narrow decurrent lobes, above finely pubescent to softly appressed pilose, whitened below and softly appressed pubescent, the veins pilose, subleaflets narrower than in the type, often borne well forward in the interspace. Stipules irregularly cut-serrate or dentate-lobed, usually less incised than in the type with shorter termination, the upper ones often dentate-serrate on the inner margin and more spreading. Fruit often with more convex disk and longer more spreading bristles, usually also with a perceptible rim. Apparently the tuberous thickenings of the roots tend to become stouter than in type and to develop on shorter roots; the largest found were 3½′ long by 3½″ thick. (Plate 282, fig. 4.)

The specimens that have come under my observation would appear to indicate that this form was of more coastwise range than the type extending from southern New York to Virginia Beach and to middle North Carolina and East Tennessee.

5. Agrimonia Brittoniana n. sp.

Becoming stout and tall and strongly virgate-branched, 2°–7° high (6° 9′ at York Harbor, Maine), the stems sometimes 4″–5″ thick at the base, erect, but often leaning under the weight of the heavy fruiting racemes, somewhat aromatic. Stem roughened with glandular papillae and hirsute with short spreading brownish hair which passes into a downy or pilose-hairy pubescence in the racemes. Leaves numerous, often ascending or subappressed, 4′–8′ long, 2′–4′ wide, the villous pubescent leafstalks downy-tomentose on the upper side. Leaflets 3–4 pairs or 5–6 pairs on the narrower and longer-petioled lower leaves, often directed sharply forward, strongly veined, becoming thickish and rugose, dark green above and more or less hispidulous or scabrous, at least near the edges, the margins finely ciliolate, below paler and pubescent (soft-

pubescent to nearly glabrous) with longer usually subappressed brownish hairs on the nerves and freely sprinkled with minute glistening glandules, in shape lanceolate to elliptic or ovate-elliptic, tapering from near the middle to either end, often decidedly tetragonal or rhomboid, acuminate or very acute, sharply serrate with mucronulate often deeply cut teeth (rarely with broader even subcrenate teeth), the narrowed base and acuminate apex often entire, usually petiolulate or the distal pair sessile and decurrent, the odd leaflet sessile or on a foliolate stalk and frequently pinnatifid at the base, the lateral leaflets more rarely basally pinnatifid, but never on the lower side in the distal pair. A common size of the leaflets is 2′ × ¾′, and extreme size 3½′ × 1½′ (on the lower leaves the leaflets are often shorter and less pointed with more deeply cut narrower teeth). Interposed leaflets 2–7 pairs, frequently subopposite, narrow, often linear-oblong, the main pair dentate-serrate above the middle, the others much smaller or minute, entire; not seldom a minute pair subtends a pair of leaflets like a set of stipels. Stipules lanceolate to half ovate, laciniate or cut-lobed, the terminal lobe broader and acuminate sometimes with one or two teeth on the inner margin. Main racemes 12′–18′ long, obscurely pulverulent beneath the pubescence, densely flowered except near the base, some of the flowers often subverticillate-clustered, rarely loosely flowered, erect or ascending, at maturity often declined from the weight of the abundant fruit. Flower-buds mammillate; flowers 3″–5″ wide, shorter-pedicelled than in *hirsuta*, the petals more rounded, mostly thicker and deeper yellow; anthers smaller with narrower connective; bracts smaller and less ciliate; bracteoles ovate, short-acuminate, entire or slightly lobed. Mature fruit closely reflexed against the pedicel and stem, large, 2″–3″ broad, 3″–4″ long, rather long-turbinate, the walls thickened and much indurated, strongly fluted between the deep furrows, minutely puberulent-granular and with traces of appressed hairs, the furrows strigose-canescent; disk becoming flat or concave, marginless; bristles numerous, short, one-quarter to one-third the length of the fruit, at first ascending and erect, finally connivent in a conical mass over the concealed calycular process. Sepals less acuminate than in *hirsuta* and more canescent within the tip, the apex at maturity scarcely hooked. The tips of the bracts, sepals and bristles with the callosities tipping the teeth of the leaves early become tinged with reddish-purple. Rootstock much as in *hirsuta*, but even stouter, the long roots as in that species slightly thickened throughout and not tubiferous. (Plate 282, fig. 2.)

Roadsides and borders of woods, flowering from the end of June to late in August. Usually forming close colonies or compact groups.

SPECIMENS EXAMINED:

Maine, St. Francis, St. John's River, Aug. 10, 1893. M. L. Fernald.

Canada, Notre Dame du Lac, Temiscouata Co. Aug. 6, 1887. John L. Northrop.

New York, near Elizabethtown, Essex Co. Sept. 5, 1892. N. L. Britton

" Tannersville, Green Co. Aug. 7, 1891. Miss Anna Murray Vail.

" White Plains, Westchester Co. Miss Phoebe McCabe.

Massachusetts, Lenox. July 11, 1889. W. M. Whitfield.

Pennsylvania, Lycoming Co. September 18, 1890. John K. Small and A. A. Heller.

West Virginia, Lone Tree Knob, Summit. C. F. Millspaugh, M. D. Flora of West Virginia, No. 450.

Montana, Belt Mountains, near Hound Creek. Aug. 2, 1883. F. Lamson Scribner.

Wyoming, Laramie Peak. Aug. 8, 1895. Aven Nelson. Flora of Wyoming, No. 1653.

I have also received the plant from Lewis and Ulster Counties, N. Y., and have collected it at York Harbor, Maine, the type locality, and in the Pocono region of Pennsylvana.

Type specimens from York Harbor are deposited in the Herbaria of Columbia University, and the New York Botanical Garden.

I take pleasure in naming this species in honor of Dr. N. L. Britton.

To anyone not having given particular attention to our species of *Agrimonia* it is altogether likely that this plant would pass unquestioned for *A. hirsuta*. It has more the general aspect of that species than of any other, the large fruit distinguishing it at once from *A. mollis*, with which in some respects it appears to have closer affinity. From *hirsuta* it may be readily distinguished by reference alone to its hoary pubescent racemes and darker green acuminate leaflets pubescent on the lower surface. It is less glandulose and aromatic than *hirsuta* and grows to be stouter and taller with straighter stem, stouter more ascending branches and longer more virgate racemes. The hairiness of the stem is also of a different character, being coarser and denser, with shorter, stiffer hair. The leaves are commonly narrower and less spreading, the thicker rugose-veiny leaflets more sharply serrate and acuminate with pubescent lower surface bearing brighter glandules and having the margins ciliolate instead of ciliate-fringed. Numerous specimens of *hirsuta* have failed to show any indica-

tions of incised bases of the lateral leaflets or a decurrent distal pair, or subleaflets in the position of stipels. The stipules of *A. Brittoniana* are narrower and more incised than those of *hirsuta*, and the bracteoles are notably unlike. The fruit, which is more crowded and closely reflexed, is of a different form, wanting the expanded marginal rim, tumid disk and contracted base characteristic of the fruit of *hirsuta* and, at maturity, presenting a signally diverse appearance from all our species by reason of the conical mass of connivent bristles.

From *A. mollis* the species differs in greater size, the stouter stem harshly hirsute instead of loosely villose or tomentose-pubescent, larger and thicker acuminate leaves provided with shining glandules on the lower surface and quite wanting the obovate or oblong figure and crenate or dentate margins of those of *mollis*, larger, more crowded flowers, much larger, more turbinate and deeply sulcate fruit having the bristles crowded and connivent instead of loosely ascending or erect.

The general character of the pubescence and branching of *A. Brittoniana* is much like that of *A. parviflora*, and the glandules beneath the leaflets present nearly the same appearance in both species. Other, if slighter, evidences of relationship between the two plants may also be noted, such as the sharply serrate often narrow leaflets of *Brittoniana*, the occasionally decurrent distal pair, the narrow and numerous subleaflets, the elongated racemes. These characteristics are more or less destinctive of *Brittoniana* among our species other than *parviflora*, in which they all find a more pronounced expression. The fruit of the two species is, however, remarkably different.

A. Brittoniana is in fact very distinct from any American species while nearly related to certain Asiatic forms—*A. viscidula* Bge., *A. pilosa* Ledeb. and *A. Dahurica* Willd., plants which have been variously confused together by authors, and all of which have finally been referred to *A. Eupatoria* L.

6. Agrimonia parviflora Soland.

Aromatic and glandulose, commonly 3½°–4½° tall (1½° to over 6°) virgate-branched above, the ascending branches simple or loosely few-branched and forming elongated strict racemes. Stem stout, becoming 4″–6″ thick below, papillose-roughened and

densely hirsute with spreading brownish hair which conceals a fine surface pubescence and passes into a close hoary pubescence in the racemes; in immature plants the hairiness is very dense and subappressed, the young branches and racemes densely canescent-pilose. Leaves bright green, numerous, mostly spreading, but often the lower leaves are deflexed, those above spreading, the upper ones rapidly diminished in size and ascending or erect, mostly oblong to narrowly-oblong in general outline, 4′–12′ long, 2′–7½′ wide; leaflets commonly 11–17, or sometimes as many as twenty-three on the narrowed lowermost leaves, strongly-nerved and rugose, minutely petiolulate or sessile, spreading, the distal pair obliquely contiguous to the odd one and often decurrent on the leafstalk, the lower pairs frequently somewhat alternate, lanceolate, sometimes narrowly lanceolate, tapering to either end, acutely serrate, 1′–4¼′ long, 4″–14″ wide, a common size being 2½′ × 8″–9″, above obscurely hispidulous to glabrous, usually finely scabrous near the edges, the margins minutely ciliolate, paler below and thinly to softly pubescent, with longer appressed or spreading often brownish hairs on the nerves and sprinkled with minute shining glandules. Leafstalk villous, tomentose-pubescent on the upper side. Interposed leaflets crowded, mostly 4–5 pairs except in the lowest interspaces, often subopposite, mostly narrowly oblong and sessile by a broad base, the main pair sharply serrate to below the middle, separated by only a minute pair from the succeeding pair of leaflets, the others gradually smaller, all but the most minute sharply-toothed. Stipules, except the reduced lower ones, broadly cordate-amplexicaule, sometimes 1′ broad, the outer margin serrate or cut-serrate, deeply cleft at the tip into a narrow attenuate lobe sometimes 1′ long, which stands either abruptly erect against the stem or is bent sharply backward. Racemes glandulose beneath the pubescence, mostly erect or sharply ascending, 10′–21′ long, many-flowered. Flowers 3″–5″ broad, rather pale yellow with thin narrow petals; anthers small with broad connective. Bracts very small, pilose-pubescent, the lobes filiform; bracteoles very small, trifid. Flower-buds very small, somewhat obovoid and subtruncate, slightly mamillate, somewhat glandulose, sepals ovate-oblong, acute. Fruit small, nodding on slightly spreading pedicels, 1″–2″ wide and long, minutely glandulose; the slender stipe-like base slightly strigose, the body subglobose, short-turbinate or hemispheric below the bristles, the disk much elevated; bristles medial on the fruit, the outer short and reflexed, the innermost erect, equalling or exceeding the broad subtruncate calycular process. Base of the stem bulbous-thickened in the form of an oblong tuber sometimes nearly 1′ in diameter. Roots not tuberous-thickened.

Comes into flower from the middle to the end of July, continuing to bloom till about the middle of September.

This species is naturally a plant of low damp grounds and in such situations reaches its fullest development, commonly growing in scattered communities about the borders of weedy thickets. Occasionally it establishes itself in dry soil and becomes much reduced and quite distinct in appearance from the normal plant, though clearly nothing more than a dry ground state of the species. Extreme examples of this form are only 1½° tall and simple, terminating in a raceme 6′–8′ long; the leaves are much crowded, often reflexed and not larger than 3′–5′ long by 2′–2½′ wide; the small leaflets number only 3–5 pairs and are mostly elliptic and finely and sharply serrate, the subleaflets reduced in size and number and obovate, the stipules very small; on small sterile plants, the small leaflets may be oval and rather bluntly serrate and sometimes number only 2–3 pairs. (Plate 283, fig. 7.)

7. Agrimonia incisa T. & G.

From 1°–3½° tall, either simple, terminating in an elongated strict raceme, or bearing also ascending racemes from bracts or reduced leaves on the upper part of the stem. Stem clothed with a close soft-pubescence and villous with loosely spreading hairs which become subappressed and more pilose above and disappear in the pubescent and glandulose racemes. Leaves numerous, rather close and ascending, becoming gradually smaller and appressed above, narrowly-oblong or oblanceolate in general outline, 3′–6′ long, 1½′–2′ wide, the leafstalks tomentose-pubescent and villose. Leaflets thickish, prominently veiny, commonly 4–5 pairs, short, mostly oblong and ¾′ in length, 4″–7″ wide, sessile, or subpetiolulate, abruptly acute at base, rounded or acute at apex the odd one rather longer and with more narrowed base, acutely incised-serrate with few (3–6 on each side) salient, often slightly recurved teeth penicillate-haired from the apex, upper surface velvety, lower surface soft-pubescent and pilose-hairy, thickly covered with minute shining glands. Subleaflets a small 3-cleft pair in each interspace, with or without a minute entire pair on either side. Stipules narrowly laciniate-lobed, the terminal lobe longer, often cut on the inner side. Flowers rather large, rather loosely disposed on short subappressed pedicels; sepals elliptic; bracts and bracteoles very small. Fruit about 2″ long, 1″–1½″ wide, short-obovate or obconic with rather broad furrows, the numerous crowded bristles mostly marginal, ascending and erect, exceeding the broad obtuse calycular process. Roots not seen. (Plate 283, fig. 8.)

Dry pine woods, according to the label on one specimen.

Explanation of Plates 282 and 283.

Fig. 1. *Agrimonia hirsuta* (Muhl.).
" 2. " *Brittoniana* n. sp.
" 3. " *mollis* (T. & G.) Britton.
" 4. " *mollis* var.
" 5. " *pumila* Muhl.
" 6. " *striata* Michx.
" 7. " *parviflora* Soland.
" 8. " *incisa* T. & G.

Geum Canadense flavum (Porter) Britton, a valid species.

By Eugene P. Bicknell.

This plant is clearly an excellent species and should stand as *Geum flavum* (Porter). It is common in the vicinity of New York and shows itself to be perfectly distinct from its near relative, *Geum Canadense* Jacq., with which it is often found associated. Its points of difference from the latter are by no means confined to the size and color of the petals, but involve the pubescence, the form and texture of the leaves the branching of the inflorescence and other less obvious features. As these characters have never been pointed out, it may be useful to draw attention to them.

Geum flavum is much more coarsely pubescent below than *Canadense*, in which the basal petioles and lower part of the stem are often glabrate or only sparsely pubescent; in *flavum* the lower stem is hirsute-pubescent, often equally so with *Geum Virginianum* L., the leafstalks spreading-villose.

The leaves of *flavum* are mostly larger, thinner and duller green than in *Canadense*, often becoming very large and lax. The largest in specimens before me are 8′ long by 7′ wide on petioles 3′ in length, dimensions which greatly exceed anything seen in *Canadense*. The long-petioled basal leaves at flowering time are exceedingly multiform, varying from cordate-orbicular through trifoliate to pinnate with two or three pairs of leaflets, showing a much readier tendency to a pinnate form than those of *Canadense* and to the development of small subleaflets on the petiole. The lower cauline leaves reveal the same tendency to greater subdivision than those of *Canadense*, which are rarely other

than trifoliolate or subpinnate. In *flavum* they are usually distinctly pinnate with 3–7 leaflets, the odd leaflet elongated and obliquely pinnatifid or pinnately-parted into oblong decurrent lobes; the lowest pair of leaflets are frequently also pinnatifid. In the trifoliolate stem-leaves of *flavum* the end leaflet is much longer relatively to the lateral ones than is the case in *Canadense*, and the simple upper leaves are mostly oblong or narrower with often obtuse basal lobes, usually in marked contrast with those of *Canadense*, which are rhombic-ovate or obovate and cuneate with acuminate or very acute lobes or angles mostly at or above the middle.

The dentition of the leaves in *flavum* is coarser than in *Canadense*, especially in the upper leaves, which are very coarsely dentate with irregular shallow teeth, in striking contrast with the much more finely and acutely dentate-serrate leaves of the latter.

The stipules of *flavum* are conspicuously larger than those of *Canadense* and variously incised and lobed; an extreme size is 1¾′ long by 1¼′ broad; the largest on specimens of *Canadense* now before me are 8″ x 4″. The pubescence of the leaves is in *flavum* coarser and looser than in *Canadense*, especially along the veins on the lower side of the basal leaves; it is much sparser on the upper leaves which are sometimes glabrate; in *Canadense* the leaves beneath are finely soft pubescent and velvety to the touch.

While *flavum* is generally more slender and weaker than *Canadense* this is not always true, except perhaps of the inflorescence, which is simpler and fewer-flowered with longer, more ascending branches and peduncles, the bracts often more foliaceous and sometimes entire.

The flowers of the two plants are always conspicuously different and constitute their most obvious distinctive character. In *flavum* the very small petals are cream-color or palest yellow and much shorter than the lobes of the calyx, 1″–1½″ long, ½″–1″ wide, linear-oblong or often broadened to the abrupt or truncate often retuse tip; in *Canadense* they are pure white, oblong or obovate, and two to four times as large (2″–4″ long, 1½″–3″ wide) equalling or exceeding the calyx-lobes. In both species the anthers show a shade more color than the petals. The flowers differ further in the sepals, which in *Canadense* are more accuminate, and in the bractlets of the calyx, which are rather larger in *flavum*. In

the latter the flowers are at first nodding; in *Canadense* they are erect or sometimes a little declined.

The fruit-heads of *flavum* are rather larger and more densely-fruited than in *Canadense* and usually paler green, and the mature achenes are slightly larger with longer slenderer beak. The receptacle is also longer and more cylindric, with coarser and stiffer tawny hair; in *Canadense* it is ovoid and clothed with longer and weaker white hair.

Geum flavum needs no close comparison with the very distinct *G. Virginianum*, although according to our text-books its flowers would refer it to the latter rather than to *Canadense*, and this very mistake appears to have been made in some of our local lists. It may be noted, therefore, that the flowers of *Virginianum* are considerably larger, especially the central carpellary portion; the creamy-white petals are larger, 2″–3″ long, 1½″–2″ wide and obovate-oblong, with revolute margins, thus often appearing linear. The pubescence of the stem in *Virginianum* is bristly-hairy throughout. In both *flavum* and *Canadense* the pubescence above is very fine and close, in the former often with longer scattered hairs.

Geum flavum comes into flower at New York from the end of June to the middle of July, one to three weeks later than *G. Canadense*, which begins to bloom, according to the season, from the second to the fourth week of June. *G. Virginianum* flowers still earlier, usually in the first week of June.

The latter is distinctively a plant of boggy ground. *G. Canadense* is the most generally scattered of the three species, occurring in damp or dry soil in woods and thickets and along roadsides. *G. flavum* is more solitary in its habits, and grows chiefly in rich, loose soil, in copses or upland woods, often among rocks.

The range of *G. flavum* appears to be much more restricted than that of *Canadense*. Prof. Porter has found it common at Easton, Pa., the type locality, and it is also common at New York. Elsewhere it seems to have been detected only in Lancaster county, Pa., and at Marion, Va., at an altitude of 2100 feet, by Dr. Small.

It is interesting to note that this species was known to Muhlenberg, who took it up in his 'Catalogue' as *G. Virginianum* L., naming the latter plant *G. hirsutum*, and distinguishing the two species by their different times of flowering.

Terminology among the Orders of Thallophytes.

By Lucien Marcus Underwood.

"To understand things in their proper relations is an important part of a student's education." In Botany, as in other subjects of extensive specialization, the student often fails to get the bearings of his subject, and in his presentation shows an utter lack of what may be called botanical perspective. One cause of this failure is the disposition, now happily growing less, to become botanists without knowing plants; without knowing them in their gross characters as well as their microscopic, in the field in their native haunts, as well as in the paraffin bath; in their natural environment as factors in a life-struggle for existence, as well as with only an environment of celloidin. We have had instances galore of young men without this perspective who have been skilled manipulators of microscopic machinery and little more, whose productions were studies without relations, complete and excellent in themselves, but without any recognized or recognizable bearings on botanical science. May we be protected from a prospective crop of graduates under the inflowing tide of physiological botany, which promises to be the next wave of the subject that sweeps the country, for of all men who do not know plants as a part of their preparation it seems as though the physiological botanist could be capable of the most harm of any.

A second reason why this lack of perspective is sometimes so apparent is the failure to grasp clearly the system of relations existing among the various groups of plants. This is partly the fault of those who present the subject, some of whom are the products of the extreme reaction against the old and meaningless method of study of botany; partly the fault of the makers of the systems themselves. It is of this last feature that I would speak at some length.

The average student, or even the brightest one, looking through a series of modern text-books, especially those treating of the lower plants, would probably be lost in a maze at the diverse systems of terminology and subdivision that are there presented, and if he saw signs of a real system among the various combinations

proposed he would get at best an indistinct notion of relationships and coördinations. While nature does not draw many hard and fast lines, it is still possible to present in a somewhat simple manner a conspectus of the groups of living things she does develop. It is the purpose of this paper to suggest some methods in which these relations can be more satisfactorily presented to our students, with less possibility of giving them a confused conglomeration of unrelated categories.

In order to show more clearly the extent of this confusion I have selected for an illustration the group of the Ascomycetes, with particular notice of the allies of *Peziza*, and will show in parallel columns their arrangement in groups by some of the modern authors. I select this group for several reasons, among others the fact that it has been recently treated by several specialists in fungi, although most or all of them are naturally more or less influenced by the extensive researches of Brefeld. It is also a group that contains very diverse elements and permits of numberless combinations based on real or supposed relationships. (See table next page.)

Of the above statements of a system, that of Von Tafel, conservatively cautious and indefinite, is entirely silent on the group names; coördinate groups only are recognized and these may probably be taken as the conception of these relations held by Brefeld himself.

Rehm consistently uses the term "Familie" as subordinate to "Ordnung," but complicates his system by the introduction of two additional groups between order and family, "Hauptordnung" and "Unterordnung." His family names lack uniformity as seen in the examples *Exoasci*, *Dothidiaceae*, *Ascobolcae*. In fact the termination *-aceae* is used by him for groups of at least four different ranks, as: *Hysteriaceae* (Ordnung) *Pezizaceae* (Hauptordnung), *Sphaeriaceae* (Unterordnung), and *Hypocreaceae* (Familie).

Although Schroeter does not so characterize each group distinctively as "order" or "family;" their rank is clearly implied in the context and the termination *-aceae* is consistently used for the family. His ordinal groups, though mostly natural ones, lack uniformity and are often complicated in pronunciation, *e.g.*, Phacidiineae, Pyrenomycetineae, Hysteriineae.

*F. Von Tafel.**

ASCOMYCETEN
- Exoasci
  - *Endomyceten*
  - *Taphrineen*
- Carpoasci
  - Gymnoasceen
  - Perisporiaceen.
    - *Erysipheen*
    - *Perisporieen*
    - *Tuberaceen*
  - Pyrenomyceten
    - *Hypocreaceen*
    - *Sphaeriaceen*
    - *Dothideaceen*
  - Hysteriaceen
  - Discomyceten
    - Phacidiaceen
    - Stictideen
    - Tryblidiaceen
    - Dermateaceen
    - Pezizaceen
      - *Helotieen*
      - *Mollisieen*
      - *Ascoboleen*
      - *Pezizeen*
    - Helvellaceen

H. Rehm.†

3. Classe. ASCOMYCETES
1. Ord. Gymnoasceae
   - *Fam. Exoasci*
   - *Fam. Gymnoasci*
2. Ord. Pyrenomycetes
   - Unterord. Perisporiaceae (*2 families*)
   - Unterord. Hypocreaceae
     - *Fam. Hypocreaceae*
   - Unterord. Sphaeriaceae (*18 families*)
   - Unterord. Dothidiaceae
     - *Fam. Dothidiaceae*
3. Ord. Hysteriaceae
4. Ord. Discomycetes
   1. Hauptord. Pezizaceae
      1. Unterord. Phacidiaceae
      2. " Stictideae
      3. " Tryblidieae
      4. " Dermateaceae
      5. " Pezizeae
         - *Fam. Mollisieae*
         - *Fam. Helotieae*
         - *Fam. Eupezizeae*
         - *Fam. Ascoboleae*
   2. Hauptord. Helvellaceae
      - *Fam. Rhizineae*
      - *Fam. Geoglosseae*
      - *Fam. Helvelleae*
5. Ord. Tuberaceae
   - *Fam. Eutuberaceen*
   - *Fam. Balsamieen*
   - *Elaphomyceti-neen*

J. Schroeter.‡

II. ASCOMYCETES
- Hemiasceae
  1. Hemiascineae
- Euasceae
  2. Protoascineae
  3. Protodiscineae
  4. Helvellineae
  5. Pezizineae
     - *Pyrenemaceae*
     - *Pezizaceae*
     - *Ascobolaceae*
     - *Mollisiaceae*
     - *Celidiaceae*
     - *Patellariaceae*
     - *Cenangiaceae*
     - *Cordieritidaceae*
     - *Cyttariaceae*
  6. Phacidiineae
  7. Hysteriineae
  8. Tuberineae
  9. Plectascineae
  10. Pyrenomycetineae

W. Zopf.§

Gruppe IV. ASCOMYCETEN
- Ord. 1. Gymnoasceen
  - *Fam. 1. Saccharomyces*
  - *Fam. 2. Exoasci*
  - *Fam. 3. Gymnoasci*
- Ord. 2. Perisporiaceen
  - *Fam. 1. Erysipheen*
  - *Fam. 2. Aspergilleen*
  - *Fam. 3. Tuberaceen*
- Ord. 3. Sphaeriaceen
  - *Fam. 1. Sphaerieen*
  - *Fam. 2. Hypocreaceen*
  - *Fam. 3. Xylarieen*
  - *Fam. 4. Hysteriaceen*
- Ord. 4. Discomycetes
  - *Fam. 1. Pezizaceen*
  - *Fam. 2. Helvellaceen*

S. H. Vines.‖

Sub-class 4. ASCOMYCETES
- Ord. 1. Gymnoasceae
- Ord. 2. Pyrenomycetes
  - Sub-ord. Perisporiaceae
  - Sub-ord. Tuberaceae
  - Sub-ord. Hypocreaceae
  - Sub-ord. Sphaeriaceae
  - Sub-ord. Dothidiaceae
- Ord. 3. Discomycetes
  - Sub-ord. Pezizaceae
    - *Fam. Phacidieae*
    - *Fam. Pezizeae*
    - *Fam. Bulgarieae*
    - "etc., etc."
  - Sub-ord. Helvellaceae

E. Warming.¶

Sub-class ASCOMYCETES
- Series 1. Exoasci
- Series 2. Carpoasci
  - Fam. Gymnoascales
  - Fam. Perisporiales
    - *Ord. Erysiphaceae*
    - *Ord. Perisporiaceae*
    - *Ord. Tuberaceae*
  - Fam Pyrenomycetes
    - Sub-fam. Hypocreales
      - *Ord. Hypocreaceae*
    - Sub-fam. Sphaeriales (*18 orders*).
    - Sub-fam. Dothideales
      - *Ord. Dothideaceae*
  - Fam. Hysteriales
  - Fam. Discomycetes
    - Sub-fam. Phacidiales
    - Sub-fam. Stictidales
    - Sub-fam. Tryblidiales
    - Sub-fam. Dermatealeс
    - Sub-fam. Pezizales
      - *Ord. Helotiaceae*
      - *Ord. Mollisiaceae*
      - *Ord. Pezizaceae*
      - *Ord. Ascobolaceae*
  - Fam. Helvellales
    - *Ord. Helvellaceae*

* Vergleichende Morphologie der Pilze, 1892.
† Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. **1**: II., III., V., Abtheilung, 1884–1896 (Abt. V., by E. Fischer).
‡ Engler-Prantl. Die natürlichen Pflanzenfamilien. **1**: 142–224, 1894–1896. The portion after p. 178 continued by G. Lindau, who justly criticizes Schroeter's blunder of arrangement whereby the highest orders are sandwiched between lower ones.
§ Die Pilze in Schenk: Handbuch der Botanik. **4**: 271–755, 1890.
‖ A Student's Text-Book of Botany, 294–303, 1894.
¶ Haandbog i den Systematiske Botanik, 1892. (Translated by M. C. Potter, 1895, with revision of the Fungi, by Dr. E. Knoblauch).

The systems adopted by both Zopf and Vines are manifestly incomplete and are inserted simply to show the conspectus given in two standard works that have an extensive circulation in this country.

Warming's system is in some respects the most consistently carried out, but he introduces too many intermediate groups for clearness and most unaccountably makes the group *order* subordinate to *family* or even in some cases to *sub-family*. His group name *series* is not to be recommended for a group subordinate to a class.

The systems in use have thus been made confusing: (1) By lack of uniformity in terminations so that the relative rank of a group name cannot be told from its termination; (2) By confusing the usually accepted sequence of group names, so that the usual order of phylum (series), class, order and family is varied or even inverted; (3) By the use of numerous and confusing intermediate group-names which may be adapted to a monograph where details are entered into more minutely, but are out of place for presentation in a general way where clearness and simplicity ought to prevail; and finally, (4) By attempting to preserve old group names that no longer have a place in the system because they represent heterogeneous groups co rdinate with nothing now recognized.

It would seem that certain fundamental principles of terminology could be adopted that would vastly simplify the matter of a system of plants and, once in use, enable a student to more intelligently grasp the relationships of plants without subjecting him to this irregular and confusing terminology. Groups will change their limits with our increasing knowledge; new groups will appear and the system of relationships be modified with each generation, but a set form of expression once adopted might become as easy of comprehension as the simple principle involved in binomial nomeclature. Among the features of such a form of expression are:

1. The two group names above the genus should be definitely fixed and their sequence rigidly maintained. The termination *aceae* should be reserved for families in accordance with well known and long existing usage among the higher plants. To

make this termination significant every time, it should appear nowhere in the system outside of family names.

2. For the ordinal name no termination could be better than that of *-ales*.* Long usage as a "Cohort" name, simplicity of affixing and pronunciation, clearness and brevity, all recommend it. If used it ought to be used *exclusively* for orders; it would then characterize at sight the rank of the group name as the termination *-idae* does the family in zoölogy.

3. The names should as far as possible be affixed to the names of representative genera or, if not, be derived from some striking characteristic or feature of the group. Family names, for obvious reasons, should always be of the former class.

4. Miscellaneous group names need not be retained after their usefulness in the system ceases to exist. Where an older name occurs which is practically an order, in the modern sense, it is desirable, where simplicity can be preserved, to so modify the old name as to conform in termination with the new system, but the rules of priority accepted for genera and species need not necessarily apply to either family or ordinal names. It would seem better to attain uniformity of usage by other means.

As a further means of illustrating this simplicity I append the ordinal groups that I am accustomed to use in presenting the relationships of the fungi to students. Nothing is claimed for it except an adaptation of the principles above recommended to the system believed to be nearest in accord with modern research.†

* Compare the discussion of this subject, this journal, **22**: 124–129. It is only fair to state that when that paper on the classification of the Archegoniates was written I had not seen Engler's *Syllabus der Vorlesungen*, which contains certain divisions similar to those suggested in my paper and necessarily antedating it. He uses the same termination *-ales* for orders, but not uniformly, nor exclusively for groups of that rank.

† At present I am using the following presentation of the leading groups of Algae:

Class BACILLARIAE—with one order: DIATOMALES

Class CYANOPHYCEAE—with 4 orders: CHROOCOCCALES, OSCILLARIALES, NOSTOCALES, SCYTONEMALES.

Class CHLOROPHYCEAE—with 6 orders: PROTOCOCCALES, CONJUGALES, SIPHONALES, CONFERVALES, COLEOCHAETALES, CHARALES.

Class PHAEOPHYCEAE—with 3 orders: PHAEOSPORALES, DICTYOTALES, FUCALES.

Class RHODOPHYCEAE—with 5 orders: BANGIALES, NEMALIONALES, CRYPTONEMIALES, GIGARTINALES, RHODYMENIALES.

Series FUNGI of the Phylum THALLOPHYTA.

Class PHYCOMYCETES (Algal-fungi).*

Order CHYTRIDIALES. (Algal parasites).
Order MUCORALES. (Moulds).
Order ENTOMOPHTHORALES. (Insect parasites.)
Order SAPROLEGNIALES. (Aquatic moulds.)
Order PERONOSPORALES. (Downy mildews.)

Class ASCOMYCETES. (Spore-sac fungi.)

Order HEMIASCALES.
Order PROTOASCALES. (Yeast fungi.)
Order GYMNOASCALES. (Plum pockets.)
Order PERISPORIALES. (Powdery mildews, etc.)
Order HYPOCREALES.†
Order SPHAERIALES. } Black-fungi (Pyrenomycetes).
Order DOTHIDEALES. }
Order LABOULBENIALES.‡
Order TUBERALES. (Truffles.)
Order HYSTERIALES.
Order PHACIDIALES. } Cup-fungi (Discomycetes).
Order PEZIZALES. }
Order HELVELLALES. (Morels, etc.)

(Fungi Imperfecti.)§

Order HYPHALES. (Hyphomycetes.)
Order MELANCONIALES.
Order SPHAEROPSIDALES. (Spot fungi.)

* Fischer's arrangement of these forms in the order of their simplicity of reproduction and structure seems highly satisfactory. The first order forms the sub-class *Archimycetes*, with usually asexual methods of reproduction. The second and third form the *Zygomycetes*, their sexual reproduction being by conjugation. The last two orders form the *Oomycetes* in which sexual reproduction is sufficiently differentiated, so that the egg forms the passive as the antherid forms the active element.

† It is with some misgivings that this group is left as a coördinate group with the next, since it differs from it chiefly in the color and consistency of the stroma.

‡ This remarkable group, whose development is one of the triumphs of American botany, is surely worthy of ordinal rank. It is remarkable that only one of the authors quoted, mentions this extensive group, and then only as an "Anhang" to the Pyrenomycetes. And still there are Germaniacs among American botanists who continue to claim that American botany is nothing.

§ This unfortunate group is the *bête noir* of the systematist. That some of these forms are not now connected with any ascigerous form is certain. That a considerable number of them have always had a complete autonomy is highly probable.

Class BASIDIOMYCETES.

Order USTILAGINALES. (Smuts.)

Order UREDINALES. (Rusts.)

Order TREMELLALES. (Gelatinous fungi.)

Order HYMENIALES. (Mushrooms, etc.)

Order GASTRALES. (Puff balls, etc.)

In case the slime moulds and Bacteria are not to be relegated to the domain of animal life, as has been time and again suggested, they would properly form classes lower than the Phycomycetes, *viz.:* MYXOMYCETES with the Order Acrasiales, Plasmodiophorales and Myxogastrales; and SCHIZOMYCETES with the Orders Eubacteriales and Myxobacteriales. *

There still remains the systematic position of the Lichens. Since the coördination of the orders of the entire phylum Thallophyta is far from being settled owing to the limitations of our knowledge, and since the two main series, separated from each other by physiological rather than structural or morphological characters, are held apart largely as a matter of convenience, it may be better to likewise hold the lichens apart as a separate group, though the reasons therefor are much less apparent than in the separation of the algae and the fungi. The lichens are distinctively fungi and there is no more real reason for holding them apart from the fungous orders with which they intergrade than there would be in separating other parasitic forms in distinct series because of some supposed mutualism between the parasite and its host. The fact that the lichens have been treated apart from their real alliances has doubtless been the cause of some part of the confusion relating to them. The orders Pyrenolichenales, Discolichenales, Hymenolichenales and Gastrolichenales may therefore be sandwiched in among their nearest alliances in the conspectus. If held apart in a distinct series it must be understood as a matter of expediency and convenience and not an indication of natural affinity among diverse groups such as they really are.

9 DECEMBER, 1896.

* Cf. Thaxter, Bot. Gazette, 17: 389–406. D 1892.

A new Species of Nitella, belonging to the N. flexilis Series, with a Review of the allied Species.

By T. F. Allen.

(Plate 284.)

Nitella laxa n. sp.

Eunitella, monarthrodactyla, furcata, homoeophylla, gymocarpa monoica, apiculata.

Plants as long as thirty cm., or longer, diffusely branched, very flexible and translucent, bright green, of the habit and appearance of *N. flexilis*. Stem 500 μ in diam., verticils remote, becoming crowded above, of eight leaves. Leaves of lower sterile verticils long and flexible, once divided into two to four terminals. Leaves of the upper fertile verticils shorter, but still longer than the internodes, once divided; leaves vary from 300 to 430 μ in diam., once divided; terminals, one or two when fertile, two to four when sterile, one-celled, apiculate, about 250 in diam. Antheridia and oogonia single on the nodes of the leaves, the latter distinctly stipitate; coronula evanescent. Antheridium usually about 350 in diam., closely sessile. *Oospore, 410 to 485 long, 400 to 460 broad with six prominent ridges; membrane covered with a thick close felt (grumous)*, yellowish red (usually mottled with red).

Collected in Yakushiji pond, Kyoto, Japan. (Plate 284.)

This species adds another to the "flexilis" group, which may be classified at present as follows:

N. flexilis, spore membrane smooth.

N. Californica A. } spore membrane granular.
N. Mexicana A. }

N. laxa A., spore membrane grumous.

Considered as to size.

N. Mexicana, a large coarse plant, has the smallest oospores, 275 long, with 5 prominent ridges.

N. flexilis, oospores 425, with 6 or 7 thin and sharp ridges moderately prominent.

N. laxa, oospores 485, with 6 prominent ridges.

N. Californica, oospores 585, with 6 or 7 thin and sharp ridges,

New Species of Nitella belonging to the monoecious acuminatae Group, with a Review of the allied Species.

By T. F. Allen.

(Plates 285, 286.)

Nitella stellaris n. sp.

This plant is moderately branched, suberect, about 25 cm. high. The stems are about one mm. in diam.; verticils remote below, becoming crowded above, consist of eight leaves, spreading and even recurved. The lower sterile leaves, two to three cm. long, are once divided into two to four short terminals, the upper fertile leaves are once divided into two rarely three terminals. The terminals are one-celled, gradually acuminate, 180 to 250 μ diam. at the middle, and, in the upper verticils, 700 to 1400 μ long. The oögonia are aggregated to the node of the leaf. The antheridia are about 215 in diam. The oöspore 230 to 240 long by 225 broad, with five or six sharp ridges, *its membrane quite smooth.* (Plate 285.)

This species differs from *N. subspicata* Allen, by the diffuse character of its fertile verticils, less condensed than in that species, and in forms of the related species, *N. sub-glomerata* A. Br.; from the latter it may be distinguished by the membrane of the oöspore, and its general habit of growth. The proportionate length of the terminal to the primary segments of the leaves is generally as two to five.

The cluster of small leaves at the ends of the longish primary segments of the fertile leaves give a stellate appearance to the ends of the upper leaves and suggests the name; these, while scarcely "condensed," as the term is usually applied to fertile verticils of *Nitella*, are somewhat suggestive of approximating the "*sub-glomerata*" series of this group, of which this may stand as the most diffuse, followed by *capitulifera* A., *subspicata*, *subglomerata*, and culminating in *glomerulifera*, which bears a dense "head" of fertile divisions.

The plant was collected by Mr. J. W. Blankinship, in a pond near Verdigris river, Creek nation, Indian Territory, August 21, 1895.

Nitella capitulifera n. sp.

Plants diffusely branched, spreading, ten to fifteen cm. long. stem flaccid, about 700 in diam. Verticils consist of eight leaves,

Leaves of the lower sterile verticils often simple, somewhat abruptly pointed; of the upper, once or even twice divided. First segment of the leaves 680 in diam., second 500, the terminals 320 to 340. The first segment nine-tenths the entire length of the leaf, the second segments usually terminal in sterile leaves, three to six, quite short (one tenth the length of the first segment). Fertile verticils *are usually somewhat condensed in small heads, quite similar to N. stellaris* A. The leaves are usually twice divided, the terminal segments, three to four in number, are quite unequal, generally with one, scarcely longer than broad, others six or more times as long, seeming to be somewhat inflated and not always very acuminate, often *somewhat apiculate*. Antheridia 240 in diam. Oögonia, one or two at a node, with oöspores 295 to 306 long and 272 broad, with *seven* prominent ridges. Membrane of the spore reddish, *quite smooth*. (Plate 286.)

This interesting species is similar to the American *sub-glomerata* in its general aspect, though apparently much smaller; its "capitulae" are much smaller and consist of small fertile verticils arising within the sterile verticils. It differs from *subglomerata*, also, by its more inflated terminals, which are usually quite short and unequal, as well as by the character of the oöspore. From *Bellangeri* (*acuminata* var. *Bellangeri* A. Br.) it is clearly distinct, though approaching that form in which the short terminal leaflets are described by Braun as "ventricosis, longe et acutissime acuminatis;" finally from all others of the *acuminatae* group except the preceding *stellaris* A. by the smooth membrane of the oöspore. From *N. stellaris* it differs by its more diffuse habit, its smaller stems and much larger and differently shaped terminals; its larger antheridia and oögonia. From *N. subspicata* A. it differs especially in its much smaller capitulae, the shape of terminal segments of the leaves and by its larger oöspores.

This plant was collected in Japan in 1895.

The "acuminatae" group as above amplified by these new species, may be classified as follows:

Monarthrodactylae, furcatae, homoeophyllae, gymnocarpae, monoicae, acuminatae.

† Sterile divisions not exceeding the fertile verticals.

(Series of *N. subglomerata* A. Br.)

* Oögonia isolated.

a. Divisions elongated. *N. subglomerata* var. *Indica* A. Br.

b. Divisions abbreviated. *N. Mauritiana* A. Br.

** Oögonia aggregated.

§ Terminal divisions elongated, much longer than the primary; oöspore 275 μ long, membrane reticulated. *N. subglomerata* A. Br.

§§ Terminals abbreviated, less than half as long as the primary divisions.

a. Terminals one-half to one-fifth the length of the primaries, oöspore 240 μ long. *N. stellaris* Allen.

b. Terminals unequal, scarcely more than one-tenth the length of the primaries, oöspore 300 μ long. *N. capitulifera* Allen.

†† Sterile divisions somewhat exceeding the contracted, fertile verticils; oöspore 225 μ long, membrane smooth. *N. subspicata* Allen.

††† Sterile divisions long overtopping the globular condensed, fertile verticils; oöspore 400 μ long, membrane coarsely granular. *N. glomerulifera* A. Br.

Internal Antidromy.

By George Macloskie.

Prof. W. J. Beal showed in the *American Naturalist* of 1873 that cones of opposite spirality grew on the same pine tree. Although for a time I failed to see matters in this way, I have, with the assistance, or rather the guidance, of Prof. G. L. Goodale, come to endorse all that Prof. Beal wrote; and furthermore, I find that the phyllotaxy as well as the conotaxy is two-fold on different parts of the same tree of the Coniferae. The branches of succeeding years appear to be often relatively antidromic, and also the side branches along one of the primary branches, and each cone appears to harmonize in its spirality with the branch which bears it, though there are apparent exceptions to this rule which may be due to the suppression of branches. Of course these phenomena cannot be observed in non-branching Gymnosperms, as the cycads, nor in tree ferns.

But in the London Natural History Museum I found a branching specimen of *Lepidodendron Sternbergii* (from Lanarkshire, Scotland) in which the leaf scars of stem and of one branch were dextrorse, whilst those of the other branch of the dichotomy were sinistrorse. This phenomenon strongly recalled the conditions of the forking rootstock of the water lily (*Nuphar*) and other plants.

The general outcome of these facts is that the law of antidromy is more complex than was first apparent; a result which

was previously indicated by the internal antidromy of *Liquidambar*. I may add that the flowers on one plant of *Hibiscus Syriacus* show a tendency to twist in relatively opposite directions; and though the phyllotaxy of that species is not easily determined (the right and left spirals being almost similar), yet in some cases opposite orders of spirality can be found on neighboring branches.

My friend, Prof. F. E. Lloyd, informs me that in the cycadaceous species *Encephalartos Altensteinii* he finds the cones on the same tree relatively antidromic. This accords with the condition of the allied coniferous order.

PRINCETON UNIVERSITY, November 3, 1896.

Reviews.

Some Analogies in the Lower Cretaceous of Europe and America. Lester F. Ward. Reprinted from 16th Ann. Rept. U. S. Geol. Survey, Part I., 1894–1895 [Washington, 1896], pp. 463–542. *Plates xcvii.–cviii. and illust. in text.*

This important contribution is of interest to both the botanist and the geologist on account of the use which is made of palaeobotanical evidence in the correlation of geologic horizons. The comparisons are chiefly made between the Potomac formation of America and the Wealden of Europe, and the author has taken a very broad and liberal view of what should be included under the latter, giving it a wider range at each extremity than is usually conceded to it. In this connection a plea is made for dual nomenclature in geology, according to the point of view from which observations are made. From the standpoint of fossils alone the Wealden would be restricted to narrower limits than if considered stratigraphically, that is from the standpoint of origin and manner of deposition of sediments.

Stratigraphically the Wealden would have to include part of what we have usually regarded as Jurassic with some of the lower Cretaceous. The method of formation and lithologic characters of the Wealden, as thus defined, evidently correlate it very closely with our lower Potomac formation, that is to say the strata are largely of estuary or fluviatile origin and consist of alternating sands

and clays, comprising a well marked geologic unit stratigraphically.

The author does not think that the lowest portion of the Potomac (equivalent to the Purbeck beds of the old world) have yet been found, and as the great angiospermous flora of the upper Potomac (Amboy clays, etc.) is not represented in England, a comparison of the English Wealden with any portion of our Cretaceous would be practically restricted to the middle and lower Potomac of the East as far as known, and to the Trinity and Kootanie of the West. In the table of distribution of the Wealden flora the range is extended geologically and geographically so as to include from the upper Jurassic to the middle Cretaceous in all parts of the world where the flora has been recognized, thus giving at once a complete list of the plants and a complete representation of their distribution vertically and laterally.

From the comparisons thus made it is evident that our lower Potomac flora has so much in common with that of the Wealden that the strata which contain it must be regarded as equivalent, whether we eventually decide them to be Jurassic or Cretaceous.

In any enumeration of this flora, cycads necessarily play an important part and cycadean trunks have received special attention from the author. Plate xcix. shows a group of twenty-one from the Purbeck beds of the Isle of Portland, England; plate c., fourteen from the Potomac formation of Maryland; plate ci., eight from the lower Cretaceous of the Black Hills, and plates ciii. and civ., two species from the scaly clays of Italy.

The fossil forests of the Isles of Wight and Portland are also described, and from the wood collected by the author sections were prepared from which two new species are described by Dr. F. H. Knowlton: *Araucarioxylon Wallacei and A. Webbii.*

In discussing the Mesozoic of Portugal, tables of geologic distribution of species for that country are given and interesting comparisons are made between the floras of certain localities and that of the Potomac.

The portion of greatest interest to the botanist, however, may be found under the chapter on Archetypal Angiosperms. It was long recognized by palaeobotanists that the highly developed angiosperm flora of the Dakota Group, Atone beds, Amboy clays,

etc., and their equivalents, containing many genera identical with those now living, must have had a more simple ancestry, and in the lower Potomac and Wealden this ancestry seems to be represented, and on plates cvi. and cvii., figures are given of some of these plants from both foreign and home localities, in order that they may be compared. Such an eminent authority as Saporta was in doubt as to their precise affinities, and classed them all under a special group, which he called Proangiosperms. When the entire flora of the lower Potomac shall have been described, we may hope to have many more representatives of these archaic types which will be of absorbing interest to the student of plant development. A. H.

Grasses of North America. W. J. Beal, M.A., M.S., Ph.D., Professor of Botany and Forestry in Michigan Agricultural College. 2 volumes. Henry Holt & Co.

The first volume of this work appeared in 1887, and was devoted to a consideration of the physiological and economic part of the subject. The second volume, which has just been published, treats of the grasses from the standpoint of the systematist. A classification of all the forms growing wild and introduced in North America and Mexico is attempted, the inclusion of those from the latter country much increasing the difficulty of the undertaking. The value of the work is greatly marred by the treatment of the plants in too large and comprehensive groups. This applies both to genera and species. To illustrate this in relation to genera, *Andropogon* may be selected as an example. In this such good and well-marked genera as *Sorghum*, *Heteropogon* and *Chrysopogon*, natural groups that are altogether too distinct to be considered as mere parts of one group, are included. In *Panicum* this same plan of extreme aggregation has been followed, both generically and specifically. In *P. dichotomum* L. the objectionable feature of this method is particularly noticeable. Six or eight good and valid species are here treated as a polymorphous one. While there may be considerale trouble as yet with the forms which have been called *P. pubescens* of Lamarck, certainly such well-marked grasses as *P. ciliatum* Ell., *P. ensiflorum* Baldwin, and what is called *P. barbulatum* Mx. are clear and distinct enough from casual observation to be kept apart as specifically distinct.

They surely should not be made into one polymorphous species, as here treated, no attempt being made to separate them even as varieties, while *P. laxiflorum* Lam. is considered worthy of varietal rank, although its limitations are less distinct than those of the species referred to above.

The present volume is plainly though neatly bound, the type clear and distinct. Some of the figures, however, do not come up as clearly as might be desired. It is the only work in this country which attempts to cover the forms from Mexico, and is a welcome addition to the literature of this difficult family of plants.

G. V. N.

Sphagna Boreali-Americana exsiccata. Prepared by Daniel Cady Eaton and Edwin Faxon. Issued by George F. Eaton, New Haven, Conn., October, 1896.

We have received the first two centuries of these very interesting North American Peat-Mosses, and are much pleased with the number and variety of species represented, the neat manner in which they are put up and the wide geographical range of the collections distributed. The bulk of the collections have been made by Edwin Faxon and Prof. Eaton in the New England States, to which Prof. Farlow and Edward L. Rand have also contributed. Dr. Evans has gathered many species in New Jersey, and Dr. Small in the Southern States, Mrs. A. M. Nicholson and C. H. Baker in Florida, A. C. Waghorne in Newfoundland, and Sandberg and Leiberg in Washington. Besides this there are a few rare arctic species from Hudson Bay and Alaska, collected by George Comer and C. H. Townsend.

We have all felt the great loss that American bryologists suffered in Prof. Eaton's death, and are glad to learn that his work was so far completed that his son has been able to issue this most attractive and useful collection.

E. G. B.

Proceedings of the Club.

TUESDAY EVENING, NOVEMBER 24TH, 1896.

Vice-President Allen occupied the chair and there were 20 persons present.

Mr. P. A. Rydberg gave an account of botanizing in the Crazy Mountains.

Dr. J. K. Small described a case of teretology in *Saxifraga fallax*.

Field notes were also presented by Mr. Howe, interesting remarks being made on the subject Algae and Ferns in California.

Dr. Britton described a new species of *Crataegus* from Virginia and North Carolina.

TUESDAY EVENING, DECEMBER 8TH, 1896.

In the absence of the President and Vice-Presidents, Dr. Havard occupied the chair. There were 30 persons present.

Mr. Thomas A. Williams was elected an active member.

The following persons were elected corresponding members:

Dr. Manuel Urbina, Director of the National Museum aud Professor of Natural History in the National Preparatory School, Mexico.

Dr. Fernando Altamirano, Director of the National Institute of Medicine, Mexico.

Dr. José Ramirez, Professor of Botany in the National Medical Institute, Mexico.

Dr. Alfonso Herrera, Calle de Santa Maria, No. 6, Mexico.

Dr. G. Barroeta, Professor of Physiology, Zoölogy and Botany, San Luis Potosi, Mexico.

Dr. Manuel Godoy, Professor in the Civil College, Queretaro, Mexico.

Dr. Jesus Sanchez, Professor of Zoölogy in the National Museum, Mexico.

Dr. Britton spoke of the recent death of Mr. Rudkin and moved that a committee consisting of the President of the Club and two others be appointed to take appropriate action. The motion being carried, the Chair appointed as such committee the President, Dr. Britton and Mr. Ogden.

The announced papers of the evening were then presented. In the absence of Dr. T. F. Allen, his papers, entitled "Descripions of New Species of *Nitella*," was read by title by Dr. Britton. They are printed in this issue of the BULLETIN.

The paper of Mrs. Elizabeth G. Britton, entitled "Contribu-

tion to the Bryology of Bolivia," reviewed the more important collections of Bolivian mosses, the treatment which they had received and the present work in progress on this subject, and enumerated the bryological collections made by Dr. Rusby in Bolivia in the years 1885 and 1886. This collection contained 96 species in 39 genera, 42 of the species being hitherto undescrbied. The paper is printed in this issue of the BULLETIN.

Dr. H. H. Rusby spoke of "Botany at the Pan-American Medical Congress held in the City of Mexico, November, 1896." This paper contained brief references to the character of the flora observed on the journey to Mexico, an account of the scientific progress in the city, especially pertaining to applied botany, and referred to the botanical work organized by the Pan-American Medical Congress. It was supplemented by remarks upon the same subject by Mrs. Britton, who attended the Congress. A number of important publications by the Instituto Medico Nacional were exhibited.

Dr. N. L. Britton described a new species of *Geranium* hitherto confounded with *G. Carolinianum*.

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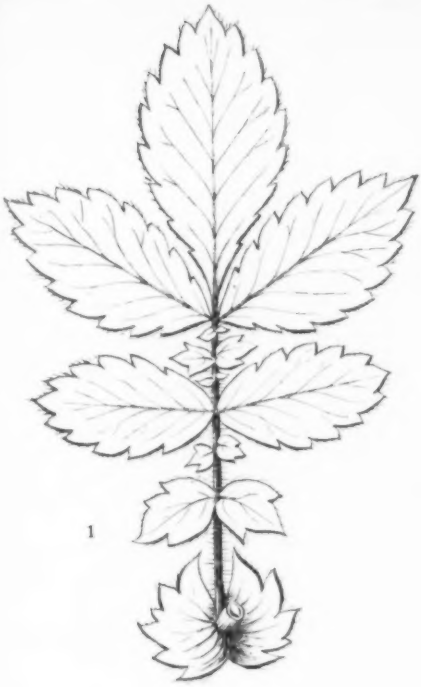

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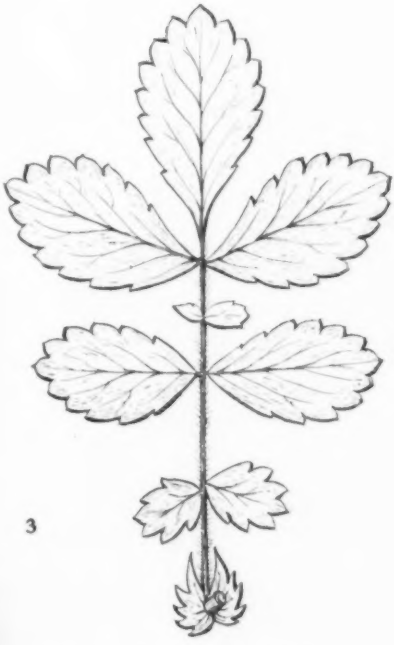

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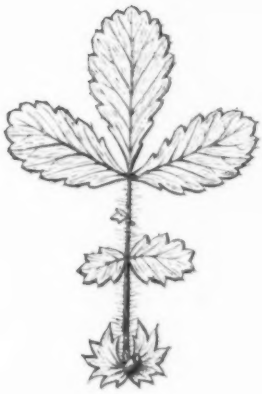

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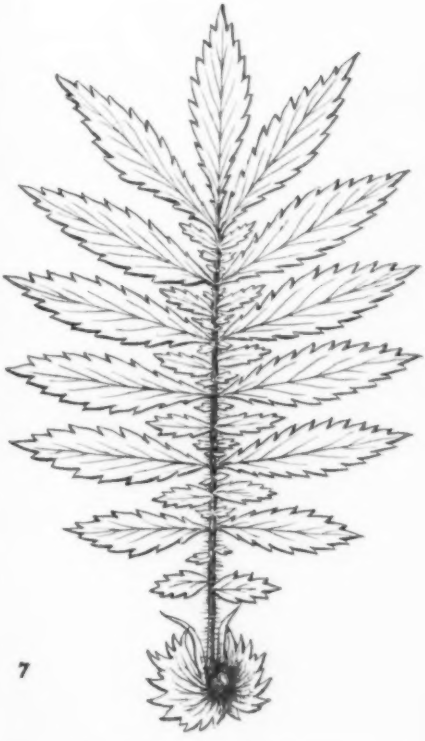

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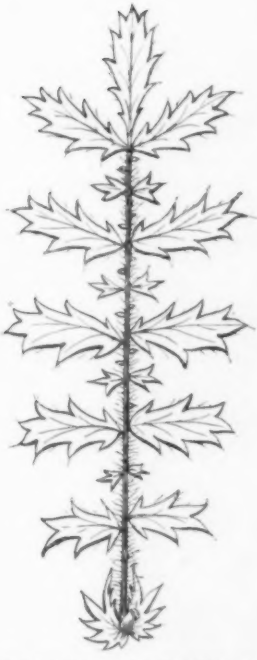

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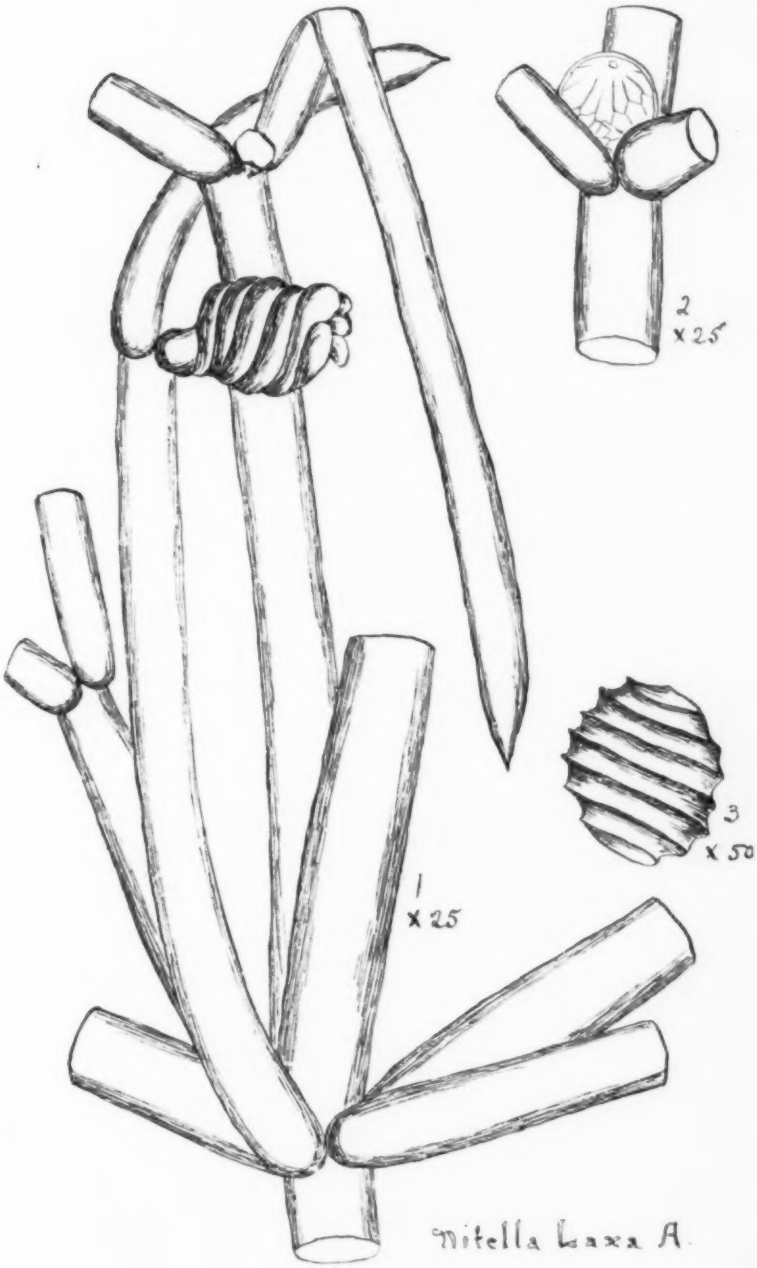

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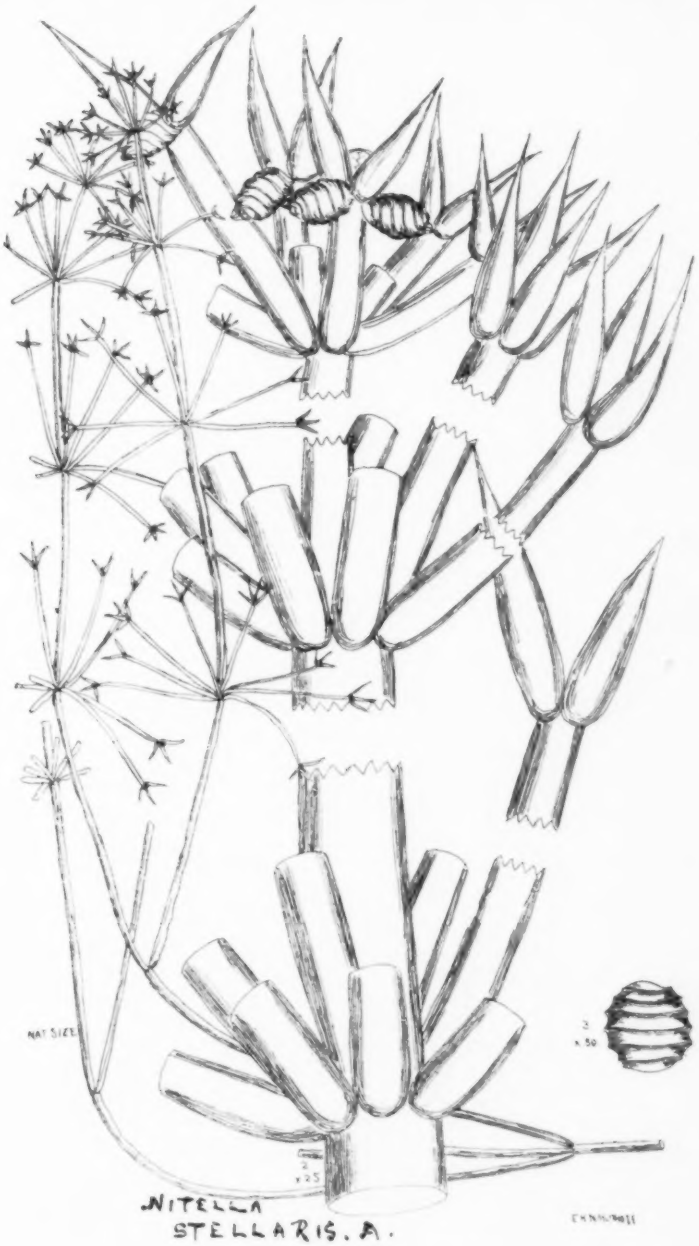

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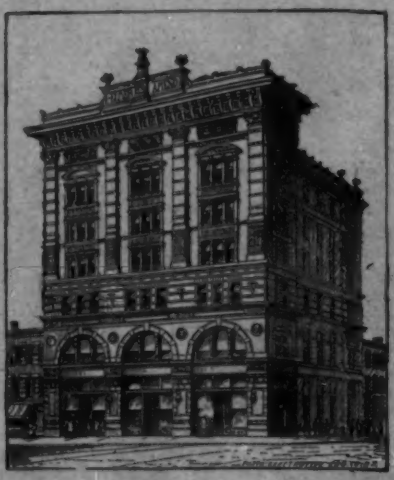

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